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COMPREHENSIVE ENERGY ACCOMPLISHMENT PLAN II, FY-75

APPENDIX A

NORTHERN GREAT PLAINS RESOURCES PROGRAM

PREPARED FOR
ENVIRONMENTAL PROTECTION AGENCY

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APPENDIX A TO REGION VIII
FY-75 COMPREHENSIVE ENERGY
ACCOMPLISHMENT PLAN

ACCOMPLISHMENT PLAN
II

REGION VIII

U. S. Environmental Protection Agency

Covering:

EPA Participation in the
Northern Great Plains Resources Program
(Montana, North Dakota, South Dakota, Wyoming, Nebraska)

May 1974

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"The coal appears to be of better quality; I expose a specimen of it to fire & found it burnt tolerably well, it afforded but little flame or smoke, but produced a hot & lasting fire..."

April 22, 1805 entry by
Capt. Meriwether Lewis in
the "Journals of Lewis and Clark"

'Strip mining in Montana could produce a 30 percent increase in the State's population' .... "If this estimate proves itself to be accurate, quality environment will assuredly decline and along with it the frontier attitude. It would be replaced with a possible and a temporary increase in living standards, an increase in crime, urban sprawl, pollution, and other urban problems."

Michael Olsen and Daniel Henning
Eastern Montana College
as quoted in The New York Times 2 Apr 73

"Energy conservation can make a substantial contribution in ameliorating or postponing the potential energy shortages faced by the United States over the next several decades. To realize this contribution, however, will require not only the political will to implement the necessary conservation measures but also the imagination and intellectual resources of the scientific community to develop new technologies to increase the efficiency of energy uses."

G.A. Lincoln, "Energy Conservation"
SCIENCE, V180, 155-162, 13 Apr 73

ABSTRACT

This Accomplishment Plan presents a plan for a second phase of the allocation of EPA resources to carry out its responsibilities for evaluating coal mining and power generation in the Northern Great Plains area of Montana, the Dakotas, and Wyoming. Emphasis of the Plan is on Regionally-coordinated (Region VIII) efforts, though projections of related Headquarters and NERC are included. This Plan also summarizes EPA's activities in the Program through 1973 and utilizes some information developed by the Program wherever pertinent.

The Northern Great Plains Resources Program is cosponsored by EPA, the Departments of Agriculture and Interior, and the States of Montana, North Dakota, Wyoming, South Dakota, and Nebraska. The Program is designed to procure, develop, and coordinate the necessary data to assist all levels of government in insuring proper development of resources of the Northern Great Plains. Emphasis over the past year has been on the coal resource and primarily on the strippable coal resource.

Emphasis on utilizing western coals has increased over the past year. The thin overburden and extremely thick coal seams allow projections of low cost recovery of the coal. However, projections of concurrent population increases, increased demands on scarce water resources, degradation of existing clear air and difficulties in rehabilitation of disturbed lands lead to concerns over the environmental impacts of coal development on the rural agrarian societies of the Northern Great Plains.

EPA has numerous responsibilities in fields related or directly connected to coal development. Among these areas are the determination of the effects of coal development on the environment and assistance to the States in the achievement of their environmental goals. The Northern Great Plains Resources Program has been an extremely viable mechanism to assist EPA in meeting its objectives. While EPA has many ongoing activities related to questions posed by the Northern Great Plains Resources Program that will continue as routine activities of its offices regardless of the future of the Program, it is hoped that the Program mechanism will continue.

The Regional office of EPA has also considered the need to perform a somewhat more active role in evaluating the impacts of and alternatives to coal development in the West. These considerations are part of the development of an energy-wide and even resource-wide action program in the Region VIII office of EPA. This more active role would possibly involve greater leadership in programs such as the Northern Great Plains Resources Program and additional involvement in legislative activities. The objective would be to assure that environmental degredation would be prevented. It may be increasingly important to assist the regional. state and local planning entities with planning, construction, and regulatory functions.

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PREFACE

The Northern Great Plains Resources Program has now proceeded in an increasingly detailed work effort for almost one year. What started out as a program of moderate duration (three years) has vacillated in scheduled duration from one to five years. Its title is interchangeably referred to as Program and Study, it's confused with the preceding North Central Power Study, and efforts vary from colation of existing data to data manipulation and supplementation with new data. Nonetheless, certain individuals and a limited number of groups have worked fast and vigorously to acquire and present pertinent data that may be considered as the "Regional Profile" or as background data with respect to evaluation of possible increased mining of coal. Individuals have analyzed the data in order to provide the public, regulatory agencies, and planning agencies with tested methodologies useful, if not necessary, for preliminary evaluation of the effects of increased coal development. The Program has continued to increase its capability to coordinate efforts that have application to the issues and questions raised by reidentification of the Northern Great Plains as a prime source of coal. In a word, the Program is good.

The primary objective of the Northern Great Plains Resources Program is stated in the Program outline (Appendix I) as follows:

> "...to provide an analytical and informational framework for policy and planning decisions at all levels of government."

The Environmental Protection Agency was instrumental in encouraging the implementation of such a program. The Region VIII office considered that this comprehensive approach was an excellent method that aligned itself well with the prevention effort, of pollution and environmental degradation, so important to the Regional activities. EPA has supported an extensive effort by EPA personnel in the first year of the Northern Great Plains Resources Program.

The Northern Great Plains Resources Program is designed to prepare an "Interim Report" in mid-1974. The studious design of the title of this report suggests thorough recognition that this 1974 report will not be the last report of such a nature for the Northern Great Plains. However, this recognition has been slow in coming from some, and seems worthy of further consideration.

It is recognized that decisions are being made, now, regarding coal mining and power plant or synthetic natural gas (SNG) plants and that many such decisions cannot wait for the preparation of some sort of "final" report in three or five years. Thus, the Northern Great Plains Resources Program has interim goals of disseminating its information to the decision-makers in a timely fashion. Unquestionably, such "interim reports" are necessary. However, when a Program examines an area of roughly 37,000,000 hectares, which includes 64 counties and portions of four, and in some cases of interregional impacts,at least five states, and when this geographical area has experienced a much different type of activity and development in the past than is now being suggested for the future, it seems reasonable to expect that certain basic data have not been collected and that certain analytical tools have not been developed. Such is obviously the case in the Northern Great Plains. An agricultural economy is being challenged by an industrial, more specifically, a coal economy. Thus, there are deficiencies in the analyses of probable impacts in many cases. Then, depending upon the desired accuracy of the analyses of environmental impacts, varying amounts of additional data may be required. In the case of the Northern Great Plains Resources Program, items like air quality, water quality, revegetation potential, social impact, mining technology, and so on must be investigated in greater depth. Otherwise the Program will not have addressed or achieved one of its objectives of filling in substantive gaps in the data. Thus, additional reports are foreseen after the "Interim Report". Whether these reports are prepared as a part of a Northern Great Plains Resources Program or some other coordinating activity is still under debate, though it is the hope of EPA that the Program will continue essentially as it is now organized.

The opposite end of the scale, that of developing an indeterminate study, also deserves treatment. The Northern Great Plains Resources Program should not be designed to continue indefinitely. At various points in time, activities will be complete, transferred to responsible parties, or curtailed. While a need for Regional coordination will remain, it is likely that the present Northern Great Plains Resources Program coordination structure would be replaced by a combination of existing or future organizations, agencies and people. Our considerations leads us to feel that the Program, as it is now structured, should be continued for an additional two years (until July of 1976) with gradual phase-out and transfer of responsibility beginning in July of 1975. Measurement and reporting functions would continue throughout.

I. INTRODUCTION

In April of 1973, it was apparent that energy shortages had contributed to renewed interest in the substantial coal resources as yet untouched in the United States. Increased awareness of the health effects of sulfur oxide focused this interest on relatively low sulfur (less than one percent sulfur) content in the Western United States.[1] Since the geographical area of these low sulfur coal resources is now an area of predominantly agrarian, rural societies, significant impositions of coal mining and energy-generation could spell disaster to the societies and cultures, not to mention the natural qualities of the topography and climate.

A program entitled the "Northern Great Plains Resources Program" was initiated in 1973 to provide baseline data and data-analysis tools, to quantify possible impacts resulting from possible development of coal resources in the four-state area of Wyoming, Montana, North Dakota and South Dakota. The Environmental Protection Agency has been a primary participant in this program over the past year. Much of the agency's participation has followed the outline provided in the "Northern Great Plains Resource Program Accomplishment Plan",[2] prepared by the Region VIII office of EPA in April of 1973.

The original Accomplishment Plan served primarily to support detailed requirements for an increased effort on the part of EPA, especially in the Region VIII office, to participate in the program during Fiscal Years 1973 and 1974. All of EPA responded enthusiastically to this Plan. The original Plan also provided a long-range estimate of the work effort needed to support the necessary effort in Fiscal Years 1975 and 1976. We have rewritten the Plan to better describe these future needs. This "Edition II" of the Plan also attempts to present summaries of past accomplishments of EPA involvement in the program, as well as ongoing activities.

While in early 1973 there were signs of energy fuels shortages -- possibly dilemmas as to what mix of fuels or what energy demand-supply projections were realistic, or desirable -- the winter of 1973-4 has brought oil and oil product shortages over the United States and the world. The import restrictions of crude oil brought on by the world situation have renewed an awareness of the limited fossil fuel reserves of the United States. These factors are treated more thoroughly in the following section of this Plan. But renewed emphasis on development of energy fuels within the United States as a result of the crude oil import restrictions has also reemphasized the need for a program like the Northern Great Plains Resources Program to provide assistance and impetus to comprehensive evaluations of energy fuels development so that the United States will not have to live with "irreparable" environmental degradation as it has as a result of coal mining 10 or more years ago.

---

[1] In fact, western coals contain sulfur in concentrations ranging from 0.4 percent to over 2.4 percent.

[2] Accomplishment Plan, Region VIII, Northern Great Plains Resource Program , July, 1973, 1860 Lincoln Street, Denver, Colorado 80203

In view of the fact that the initial Accomplishment Plan was of interest to numerous individuals and groups and is now out of print, much of the information contained therein is included here again.

National and Regional Energy Considerations

Recent national fuel (oil and oil products, natural gas) shortages in the United States have focused the entire nation's attention on the supply and demand problems associated with what is popularly called an energy "crisis". It appears that the energy "crisis" is more appropriately termed an energy "dilemma" since a multitude of choices exist when projecting both a future demand for energy and the means of supplying the demand. The dilemma involves national and international considerations; social and technological considerations; considerations that may be basic to modifying previous economic theory in terms of rate of growth, profits, returns or investments, etc.

There is increasing interest in developing a higher degree of independence from foreign energy supplies, primarily oil and oil byproducts. This and environmental concerns over pollutants from conventional conversion of energy fuels are leading to a more complete inventory, as well as identification of the need for ever more accurate inventories, of national sources of energy. Much of the reserves of conventional fuel supplies (coal, uranium, gas, oil, hydroelectric) are found in the western United States.[3] It would also appear that the West has the potential of supplying energy from more unique sources, such as geothermal resources, solar, and perhaps wind energy. While other parts of the nation contain significant quantities of fossil fuels and the potential to supply energy from non-conventional sources such as the oceans, the West embodies a somewhat unique contradiction -- it has been renowned for both its mineral wealth and its visual splendor, the latter a splendor that has been and might again be destroyed by careless extraction or development of mineral resources.

---

[3] Energy Reserves, Region VIII, 1973. A pictorial briefing document prepared by the NGPRP Staff of EPA Region VIII. Much of the information is included in following sections of this Accomplishment Plan.

The President's 1973 energy message[4] encouraged the use of domestic coal to meet the needs for energy. Since low sulfur coal laying in close proximity to the ground surface is economically attractive to energy producers, much of the near-surface coal resources in the West are important. Region VIII (of EPA) States of Montana, Colorado, Wyoming, Utah, North and South Dakota have vast reserves of low sulfur coal, much of which lays near the surface in relatively thick seams and in generally level terrain. When combined with the Four-Corners area of New Mexico and Arizona, the Region includes an estimated resource of 2 trillion metric tons of coal.

The ensuing seven subsections present quantitative estimates of the "conventional" energy reserves found within the six states of EPA's Region VIII. It should be recognized that the figures presented here are changing as new reserves are proved, or as more resources are projected. That is characteristic of things geologic. Each of the energy fuels discussed, with the exception of hydroelectric power, lies beneath the land surface, out of sight, and until mined can only be evaluated by examination of drill hole or outcrop data. As a result there can only be estimates of the amount of fuel in place until that fuel is actually removed or extracted. While we have tried to present the most recent data available to us , the estimates of reserves are always changing as more exploration occurs. Regardless, however, of the fact that exploration brings in more reserves of fuel, the total conventional energy resource available to us is finite -- it is not being renewed. Hydrocarbon fuels must be deposited and buried over geologic ages. They are not being formed at rates commensurate with present use.

Coal

Table 1 gives the estimated annual coal production rates for certain states in 1972. States in Region VIII of EPA are underlined. Annual production in the United States has been on the order of 600 million metric tons. Production from the Region VIII has recently been on the order of 50 million metric tons per year or 8.3 percent of the national rate.

Estimated resources of coal in the United States are 3.3 trillion tons or enough for about 5,500 years of use at the present rate of production (600 million tons per year). About 60 percent or about 2 trillion tons of these resources are located in the Region VIII states and the Four-Corners Area in New Mexico. Figure 1 gives some idea of the distribution and rank (heating value) of these coals across the United States and indicates that much of the western coals are of lower heating (BTU) value. Thus, it takes proportionately more western coal to produce the same heat as typical "eastern" bituminous and anthracite coals.

---

[4] New York Times, 19 April 1973, "President Offers Policy to Avert An Energy Crisis" This emphasis on use of western coals has been reiterated by private and Federal sectors with increasing frequency in 1974.

TABLE 1. - **Production of bituminous coal and lignite in the United States, by State and underground, strip, and auger mining** a/

(Thousand short tons)

State	Underground	Strip	Auger	Total
Alabama	7,588	13,177	49	20,814
Alaska	---	668	---	668
Arizona	---	2,954	---	2,954
Arkansas	8	420	---	428
Colorado	3,070	2,452	---	5,522
Illinois	31,721	33,802	---	65,523
Indiana	1,446	24,503	---	25,949
Iowa	352	499	---	851
Kansas	---	1,227	---	1,227
Kentucky:				
Eastern	37,946	22,132	8,779	68,858
Western	18,547	33,645	137	52,330
Total	56,494	55,776	8,917	121,187
Maryland	141	1,435	65	1,640
Missouri	---	4,551	---	4,551
Montana:				
Bituminous	17	7,882	---	7,899
Lignite	---	322	---	322
Total	17	8,204	---	8,221
New Mexico	1,014	7,235	---	8,248
North Dakota (lignite)	---	6,632	---	6,632
Ohio	16,269	34,077	621	50,967
Oklahoma	88	2,536	---	2,624
Pennsylvania	49,133	26,264	542	75,939
Tennessee	5,866	5,113	281	11,260
Texas (lignite)	---	4,045	---	4,045
Utah	4,770	32	---	4,802
Virginia	23,993	7,935	2,100	34,028
Washington	29	2,606	---	2,634
West Virginia	101,662	19,101	2,979	123,743
Wyoming	442	10,487	---	10,928
Total b/	304,103	275,720	15,554	595,386

a/ Mineral Industry Surveys; "Coal-Bituminous and Lignite in 1972" November 15, 1973

b/ Data may not add to totals shown because of independent rounding.

1 short ton = 0.9 metric tons

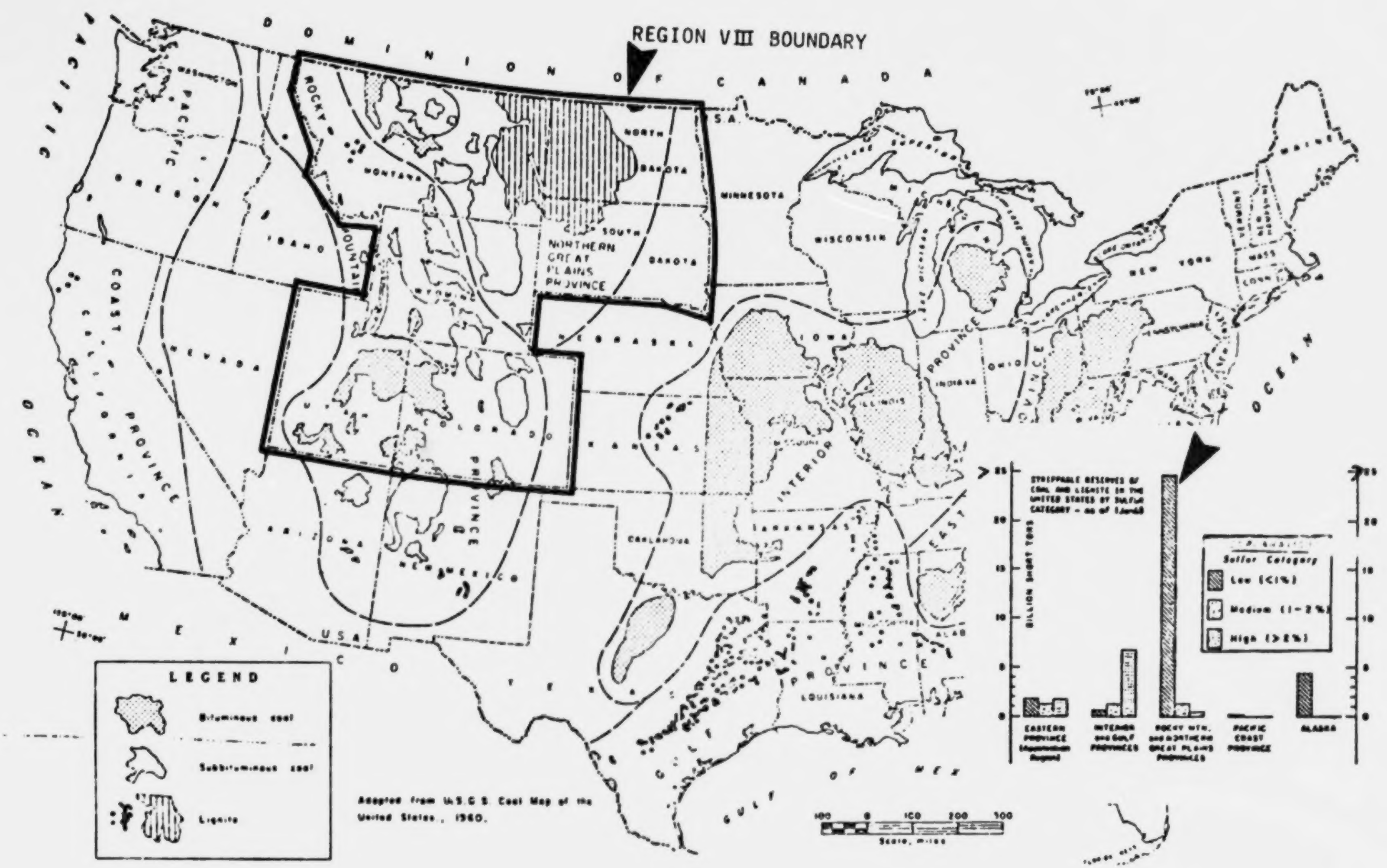

REGION VIII BOUNDARY
DOMINION OF CANADA
PACIFIC OCEAN
GULF OF MEXICO
MEXICO
OCEAN
NORTHERN GREAT PLAINS PROVINCE
ROCKY MOUNTAIN PROVINCE
PACIFIC COAST PROVINCE
INTERIOR PROVINCE
EASTERN PROVINCE
GULF PROVINCE
WASHINGTON
OREGON
CALIFORNIA
IDAHO
NEVADA
MONTANA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
WISCONSIN
ILLINOIS
INDIANA
OHIO
MICHIGAN
ARKANSAS
LOUISIANA
NEW YORK
MAINE
MASS
CONN
LEGEND
Bituminous coal
Subbituminous coal
Lignite
Adapted from U.S.G.S. Coal Map of the United States, 1960.
Scale, miles
100 0 100 200 300
STRIPPABLE RESERVES OF COAL AND LIGNITE IN THE UNITED STATES BY SULFUR CATEGORY - as of 1 Jan 68
BILLION SHORT TONS
> 25
20
15
10
5
0
Sulfur Category
Low (<1%)
Medium (1-2%)
High (>2%)
EASTERN PROVINCE (Appalachian Region)
INTERIOR AND GULF PROVINCES
ROCKY MTN. AND NORTHERN GREAT PLAINS PROVINCES
PACIFIC COAST PROVINCE
ALASKA

FIGURE 1 BITUMINOUS, SUBBITUMINOUS COAL, AND LIGNITE DEPOSITS OF THE CONTERMINOUS UNITED STATES AND COMPARISON, BY PROVINCE, OF STRIPPABLE RESERVES

after BuMines IC 8531, 1971

Reproduced from best available copy.

Significantly higher production rates from the West are probable as the demand for low sulfur fuels and substitute fuels for crude oil continues to grow. Initial pressure is placed upon those reserves which lay within about 70 meters (200 ft.) of the ground surface and which are therefore amenable to strip mining. So-called strippable resources in the United States are presented in Table 2. Of the total of 142 billion tons of strippable coal in the United States (4.3 percent of the total estimated resources) about 53 percent or 76 billion tons are to be found in the Region VIII (plus Four-Corners) states.

Figure 2 shows the general location of coal reserves in the six-state region of EPA's Region VIII.

Oil Shale

While some deposits of oil-rich sediments occur throughout the United States (see Figure 3), the organic-rich sedimentary rocks of the Green River Formation of Colorado, Utah, and Wyoming in Region VIII (Figure 4) offer the greatest promise for oil shale production in the immediate future. The Green River Formation deposits include reserves of high grade shale (greater than 25 gallons of oil per ton of shale; greater than 10 foot thick seam) representing 600 billion barrels[5] of oil. An additional 1,200 billion[5] barrels are estimated to reside in sequences of lower grade shale. By comparison, the nation consumed 5.5 billion bbl of crude oil in 1970. In 1973 the Department of Interior published a final EIS for the Proposed Prototype Oil Shale Leasing Program in the States of Colorado, Utah, and Wyoming.

The Oil Shale Leasing Program has proposed six sites of Federal oil shale for leasing to industry. The sites are to be used to test methods of extracting oil from the deposits. Each tract consists of about 5,120 acres and there are two tracts proposed for each state. Table 3 shows the lease bids that have been accepted to date (May 1974).

The Region VIII office of EPA considers the oil shale development to rival coal in its development potential and its potential for significant impact on the environment. The Regional office is therefore preparing an Accomplishment Plan for its activities in oil shale development. A plan similar to the initial NGPRP Plan addressing coal development in the Northern Great Plains and detailing the necessary efforts and support required to prevent undue deterioration of the environment is envisioned.

---

[5] U. S. Department of Interior Draft Environmental Statement for the Proposed Prototype Oil Shale Leasing Program, Volume 1. USDI, 1973, 6 Volumes, S.O.D. #2400-00776,777,784-7.

Table 2

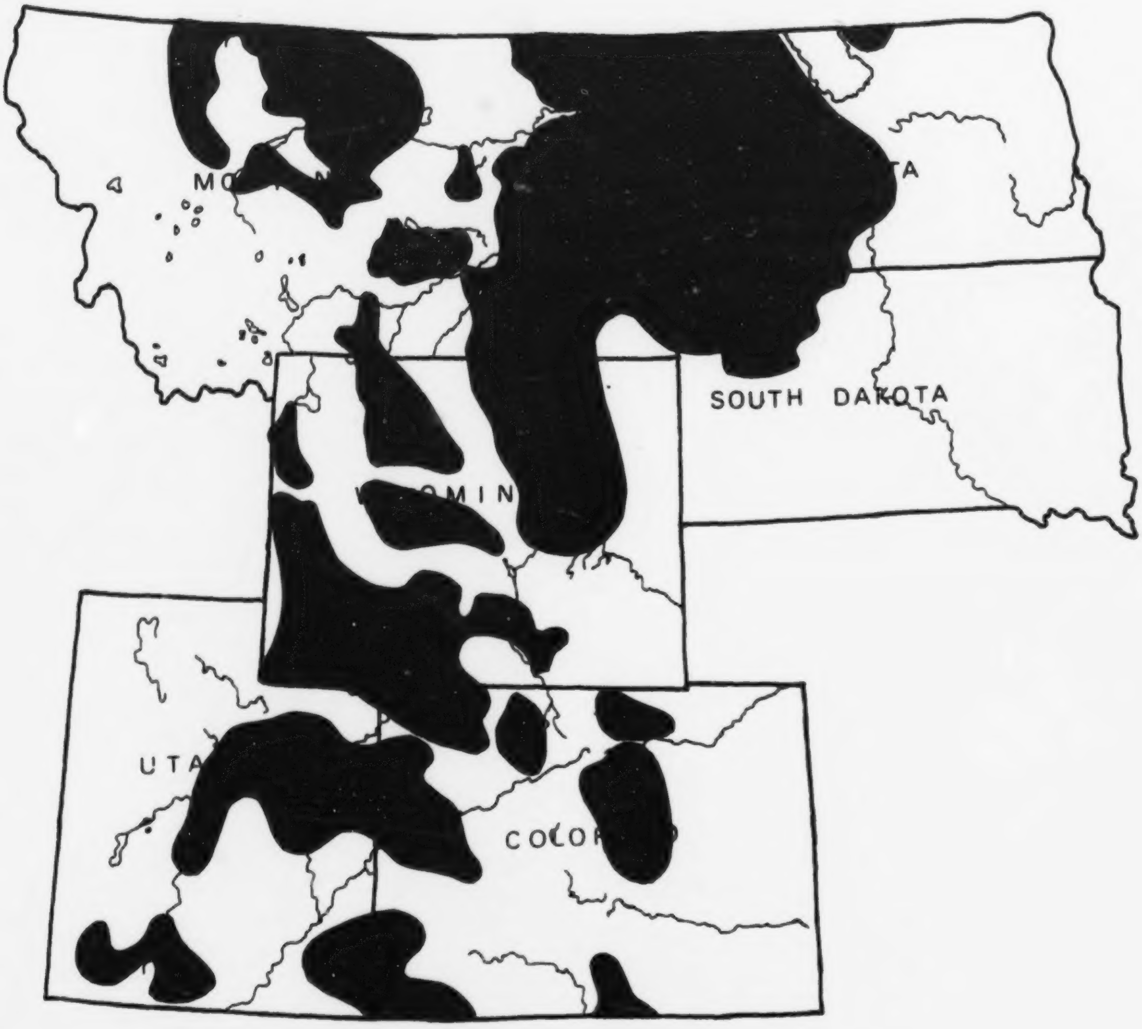
Strippable Coal
(in millions of short tons)

States[a]	Estimated Resources[b]
Montana (NGPRP)	31,857
North Dakota (NGPRP)	16,003
South Dakota (NGPRP)	428
Wyoming (NGPRP)	19,850
Four Corners (SWES)	7,862
National (NGPRP)	142,000

a. Data sources:

NGPRP	Northern Great Plains Resources Program
SWES	Southwest Energy Study

b. Overburden thickness varies with thickness of coal; maximum generally 200 feet for the thickest beds.



MO N
TA
SOUTH DAKOTA
W OMIN
UTA
COLOR O

FIGURE 2

General Location of Coal Resources in Region VIII States

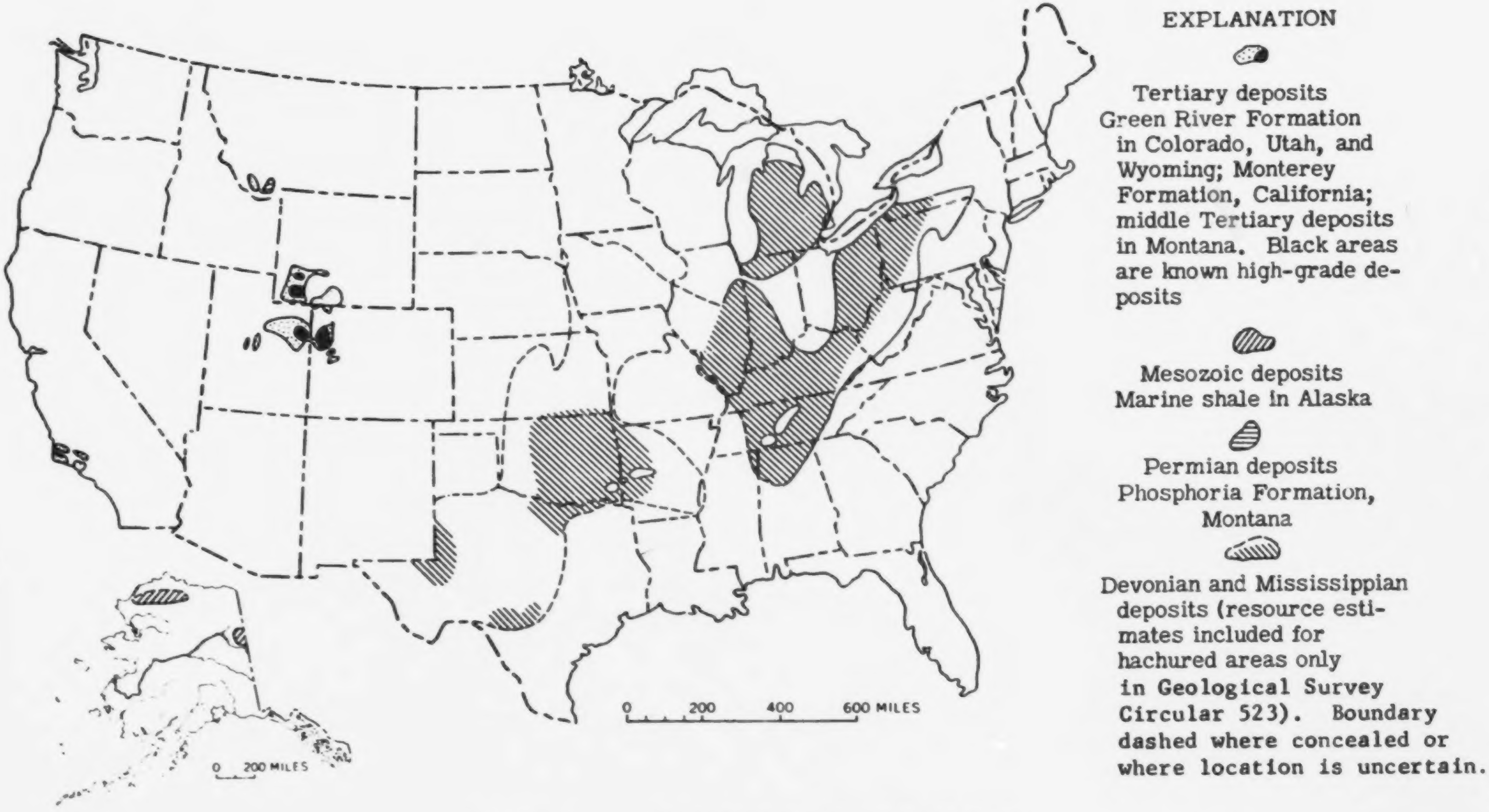

EXPLANATION
Tertiary deposits
Green River Formation in Colorado, Utah, and Wyoming; Monterey Formation, California; middle Tertiary deposits in Montana. Black areas are known high-grade deposits
Mesozoic deposits
Marine shale in Alaska
Permian deposits
Phosphoria Formation, Montana
Devonian and Mississippian deposits (resource estimates included for hachured areas only in Geological Survey Circular 523). Boundary dashed where concealed or where location is uncertain.
0
200
400
600 MILES
0
200 MILES

FIGURE 3. Principal Reported Oil-Shale Deposits of tne United States.

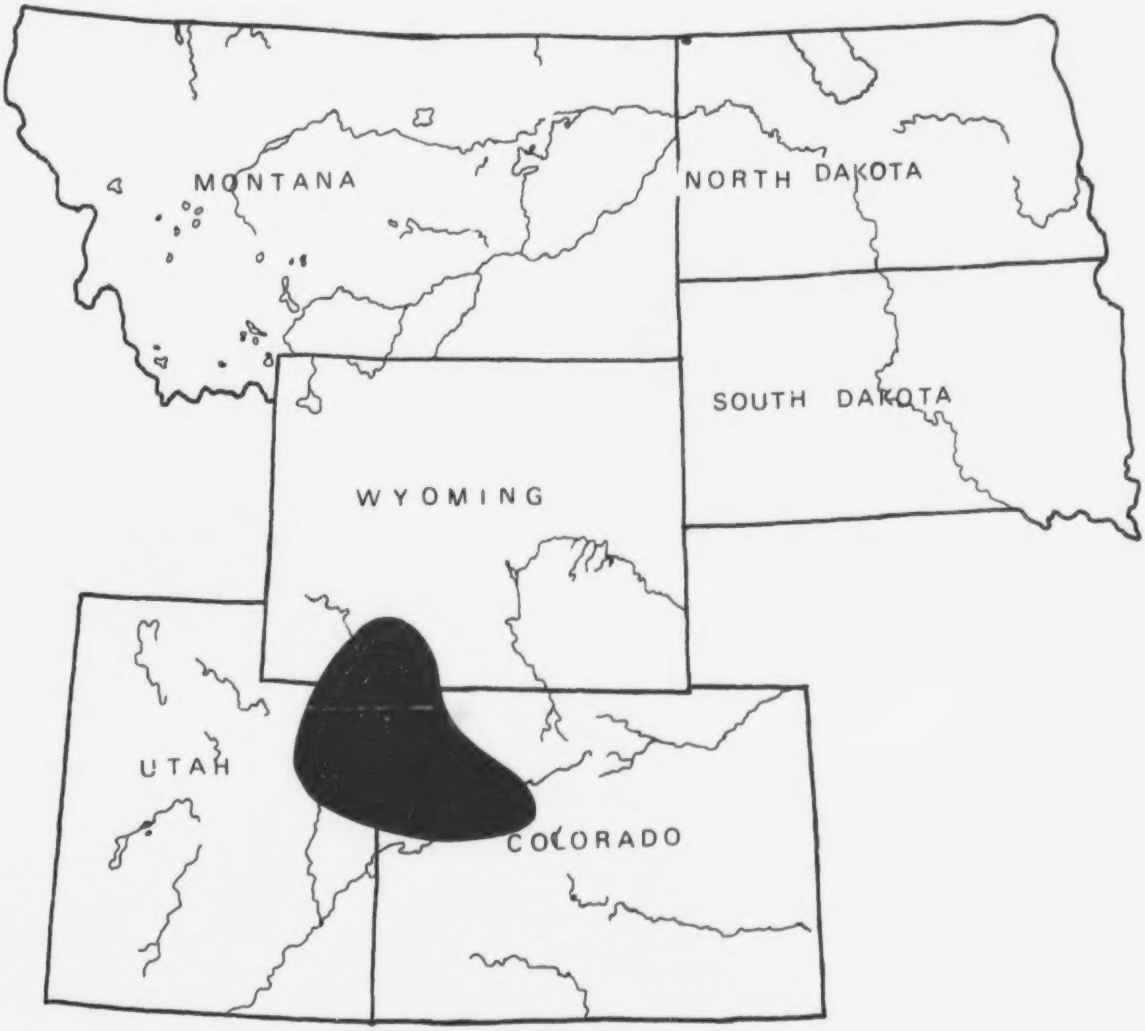

MONTANA
NORTH DAKOTA
SOUTH DAKOTA
WYOMING
UTAH
COLORADO

FIGURE 4

General Location of Oil Shale
(Kerogen-Rich Marlstone)
Resources in Region VIII States

TABLE 3

Tract	Date of Sale	Winning Bid	Company
Colorado C-a	January 8, 1974	$210,305,600	Standard of Indiana Gulf Oil Corporation
Colorado C-b	February 12, 1974	$117,778,000	Atlantic Richfield Ashland Oil Company Shell Oil Company The Oil Shale Corp.
Utah U-a	March 17, 1974	$75,596,800	Sun Oil Company Phillips Petroleum
Utah U-b	April 9, 1974	$45,107,200	White River Shale Oil (a consortion of Standard Oil of Ohio Sun Oil Company Phillips Petroleum)
Wyoming W-a	May 13, 1974	No bids received	
Wyoming W-b	June 11, 1974		

Result of Oil Shale Lease Sales as of May 15, 1974

Uranium

Uranium-bearing deposits are located throughout the United States, however, economic concentrations of uranium are few. Figure 5 portrays the general area of the United States in which commercially-produceable reserves of uranium may be expected. Figure 6 summarizes these deposits throughout Region VIII. Table 4 lists the uranium ore reserves by states as of January, 1972. These reserves are (most recently) predicated on a price of $8 per pound of U_3O_8. About 273,200 metric short tons of U_3O_8 reserves were then estimated. Ninety percent of these ore reserves were located in the Region VIII-Four Corners Area of the West[6] (includes states of Regions VI and IX of EPA). Table 5 indicates that of the 96,000,000 short tons of uranium ore shipped in the period 1948 through 1971, over 46,000,000 tons or 48 percent of the ore shipments originated from Region VIII States (Utah, Wyoming, Colorado).[7] In excess of 95 percent of the total ore shipments originated from Region VIII and Four Corners (New Mexico, Arizona) states.

Of 70 U.S. uranium ore processing mills either operating, or under construction in 1972, 13 are located in Region VIII and have 45 percent of the total nominal ore processing capacity of the United States (see Table 5b). A total of 16 mills are located in the Four-Corners-Region VIII area and contain 87 percent of the total processing capacity in the U.S.

It should be noted that the estimated reserves of uranium ore have risen significantly since 1947 when first thought was given to large-scale extraction (Figure 7). Such a response of or "growth" of reserves is often the result of increased exploration brought about by promise of increased demand. The response is by no means unique to uranium.

Crude Oil

The estimated crude oil reserves of the United States are 35 billion barrels. The comparable estimate of reserves for Region VIII states is 1.9 billion barrels or 5 percent of the U. S. reserves. Annual

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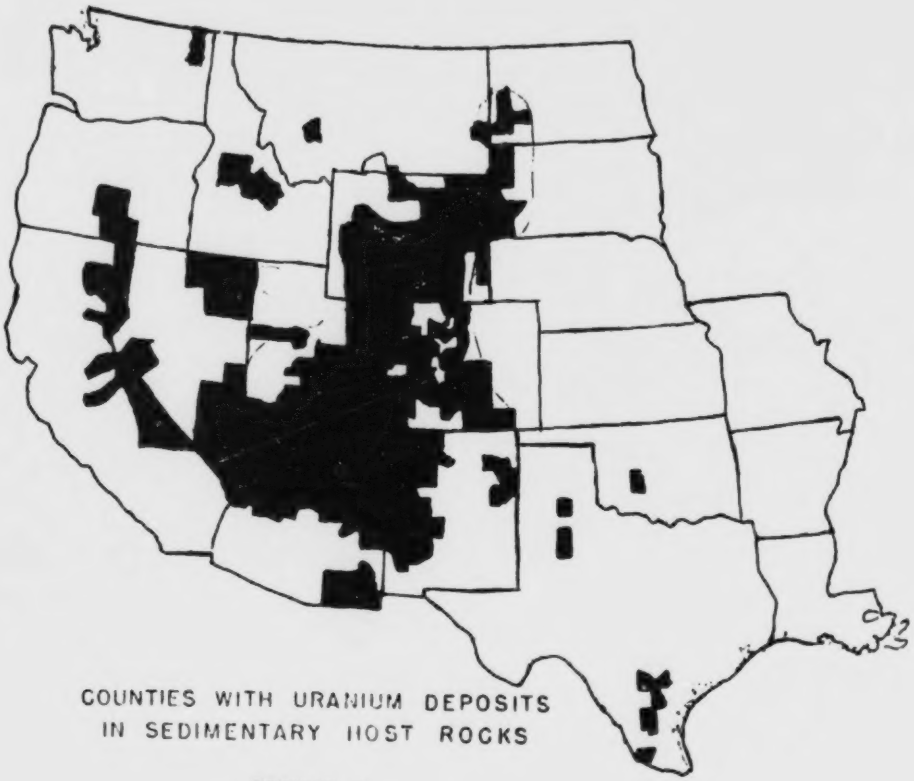
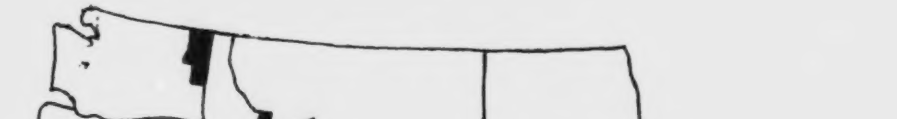
6. Of a total of 19,000,000 acres held for uranium mining and exploration, about 12,900,000 acres, or 68 percent are held in Region VIII states and over 17,250,000 acres, or 91 percent held in the Region VIII-Four Corners area.

7. Statistical Data of the Uranium Industry , 1 Jan 72 - Grand Junction Office of the USAEC, Grand Junction, Colorado 81501, P.O. Box 2567, GJO-100.



COUNTIES WITH URANIUM DEPOSITS
IN SEDIMENTARY HOST ROCKS

FIGURE 5



COUNTIES WITH URANIUM DEPOSITS
IN OTHER THAN SEDIMENTARY HOST ROCKS

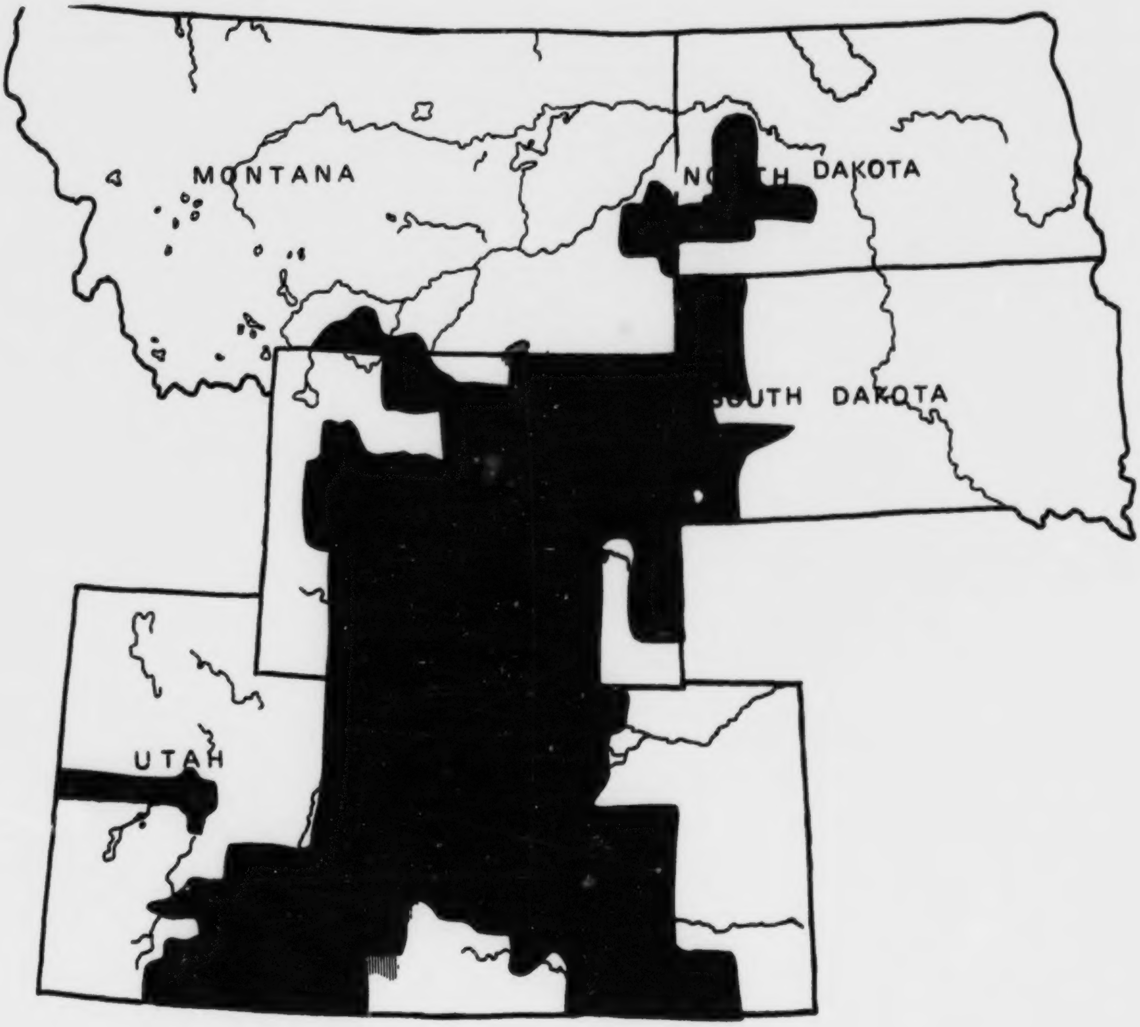

MONTANA
NORTH DAKOTA
SOUTH DAKOTA
UTAH
URANIUM DEPOSITS
URANIUM MINING AREAS

FIGURE 6

General Location of Uranium
Reserves in Region VIII States

TABLE 4: DISTRIBUTION OF 1/1/72 ORE RESERVES BY STATE
($8.00 Reserves)

State	Tons Ore	Grade	Tons U_3O_8	% Total Tons U_3O_8	No. Deposits
New Mexico	51,705,465	0.265%	137,032	50.156	67
Wyoming	51,199,682	0.185%	94,882	34.728	130
Texas	10,225,129	0.142%	14,564	5.331	39
Colorado	3,329,806	0.267%	8,905	3.259	294
Utah	2,646,394	0.325%	8,602	3.149	115
Others: Arizona, Montana, Nevada, North Dakota, Washington, Oregon, South Dakota, Alaska	8,415,201	0.110%	9,227	3.377	87
Totals	126,521,677	0.216%	273,200*	100.000	732

*Rounded

TABLE 5: URANIUM ORE SHIPMENTS TO MILLS - 1948 THROUGH 1971

By State

State	Tons of Ore	$\%U_3O_8$	Contained Tons U_3O_8**
New Mexico	41,785,800	0.22	91,044
Utah	12,872,629	0.32	40,623
Wyoming	19,429,136	0.22	42,669
Colorado	14,289,303	0.25	35,602
Arizona	2,965,900	0.30	8,950
Others*	5,289,120	0.21	10,964
Total	96,631,888	0.24	229,852

*Includes Alaska, California, Idaho, Montana, Nevada, North Dakota, Oregon, South Dakota, Texas & Washington.
**Includes miscellaneous U_3O_8 receipts.

After Statistical Data of the Uranium Industry See footnote 7.

TABLE 5b

U. S. URANIUM ORE PROCESSING MILLS
Operating or Under Construction

Company	Location	Nominal Capacity (tons ore per day)
Anaconda Company	Grants, New Mexico	3,000
Atlas Corporation	Moab, Utah	1,500
Conoco & Pioneer Nuclear, Inc.	Falls City, Texas	1,750 1/
Cotter Corporation	Canon City, Colorado	450
Dawn Mining Company	Ford, Washington	500
Federal-American Partners	Gas Hills, Wyoming	950
Humble Oil and Refining Company	Powder River Basin, Wyo.	2,000 1/
Kerr-McGee Corporation	Grants, New Mexico	7,000
Mines Development, Inc.	Edgemont, South Dakota	650
Petrotomics Company	Shirley Basin, Wyoming	1,500
Rio Algom Corporation	LaSal, Utah	500 1/
Susquehanna-Western, Inc.	Falls City, Texas	1,000
Susquehanna-Western, Inc.	Ray Point, Texas	1,000
Union Carbide Corporation	Rifle, Colorado) Uravan, Colorado)	2,000
Union Carbide Corporation	Natrona County, Wyoming	1,000
United Nuclear-Homestake Partners	Grants, New Mexico	3,500
Utah International, Inc.	Gas Hills, Wyoming	1,200
Utah International, Inc.	Shirley Basin, Wyoming	1,200
Western Nuclear, Inc.	Jeffrey City, Wyoming	1,200
Total		31,900

1/ Under construction.

After Statistical Data of the Uranium Industry   See footnote 7.

RELATIONSHIP OF TOTAL $8.00 RESERVES TO PRODUCTION
WESTERN UNITED STATES

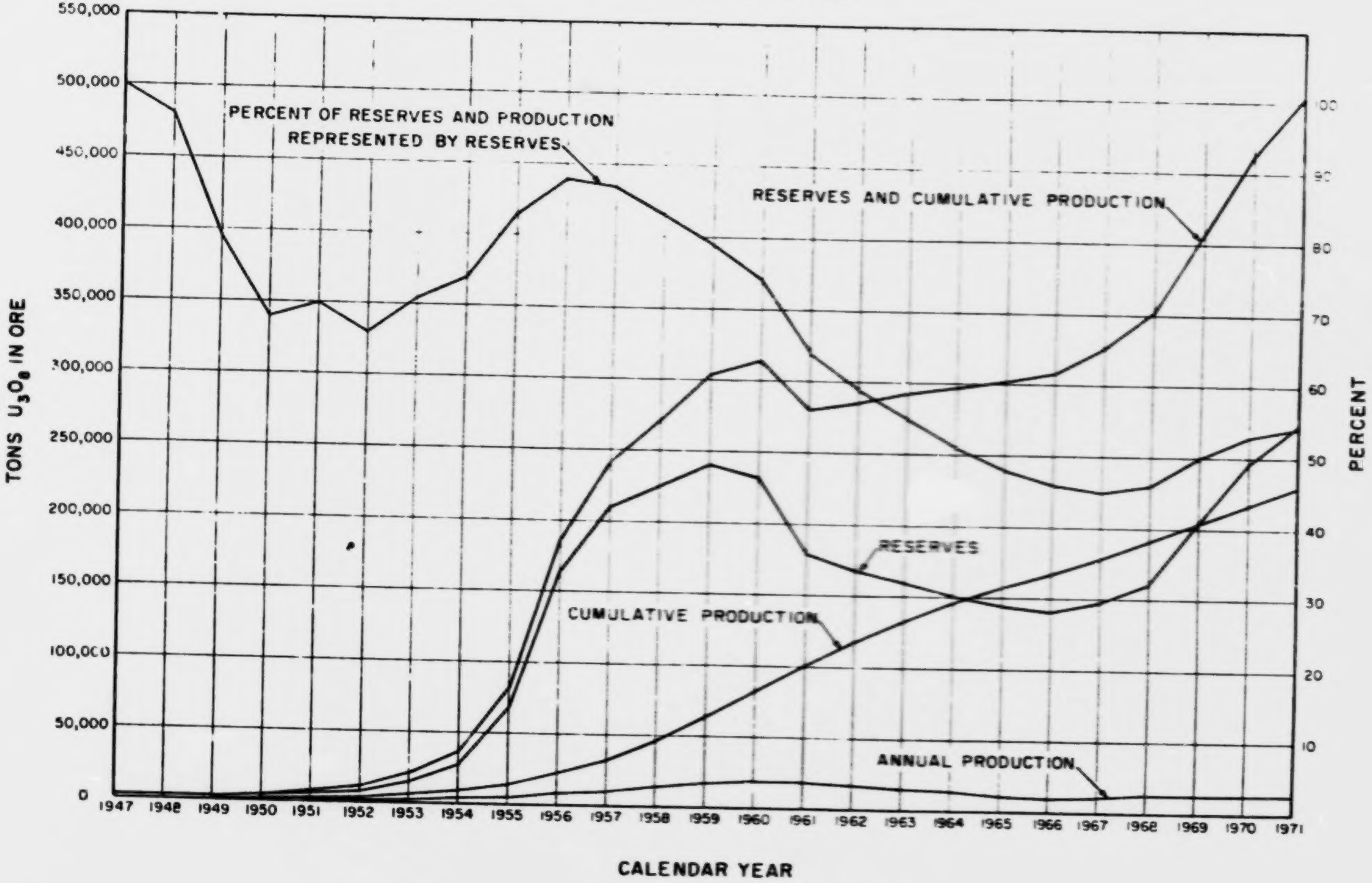


Figure 7

U. S. useage of crude oil, from both domestic and foreign supplies, has been on the order of 5.5 billion barrels. The close approximation of total U. S. Reserves to annual U. S. useage is slightly misleading due to an apparent lag between exploration for new reserves and production. But, demand for crude oil is encroaching upon U. S. reserves. Simply stated, we are using oil faster than we are finding it.

In 1972, production of crude oil from Region VIII states was on the order of 700,000 barrels per day (256 million bbls/yr) or just over 7 percent of the total U. S. crude oil and condensate production (Table 6). Addition of the Four-Corners state of New Mexico to the Region VIII production increases the area production to almost 11 percent of the total U. S. production.

Figure 8 portrays those general areas of Region VIII states in which oil, and gas, deposits may be expected.

Natural Gas

Total natural gas reserves in the United States, recoverable by conventional, "economic" methods, have been estimated to be 250 trillion standard cubic feet (SCF). The comparable natural gas reserves in Region VIII states (see Figure 8) have been estimated to be 10 trillion SCF or 3.5 percent of the total U. S. reserves. Annual useage of natural gas from all sources was about 23 trillion SCF (in 1973).

Production of natural gas from Region VIII was about 1500 million SCF per day in 1972 (550 billion SCF/yr) or 2.4 percent of the total U. S. production. Production from Region VIII and Four Corners' States was approximately 7.5 percent of the 1972 production (Table 7).

The Region States and New Mexico also contain significant reserves of so called "tight" natural gas. Tight gas refers to natural gas trapped in rock strata of low porosity. Extensive conventional fracturing techniques as well as the more controversial nuclear stimulation (fracturing) have been proposed to free these gas reserves. Recent estimates[8] of potentially recoverable trapped gas in areas of Wyoming, Colorado, and Utah amount to 600 trillion SCF. This is in addition to the estimated U. S. reserves of conventionally-produced natural gas (285 trillion SCF).

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[8] National Gas Technology Task Force for the Technical Advisory Committee of the National Gas Survey by the Federal Power Commission.

TABLE 6

U. S. Production of Crude Oil and Condensate
1972 (Preliminary)

State	1000 bbls/day	State	1000 bbls/day
Alaska	202	Mississippi	168
Alabama	27	Montana	92
Arizona	3	Nebraska	24
Arkansas	50	New Mexico	304
California	952	North Dakota	56
Colorado	85	Ohio	22
Illinois	97	Oklahoma	572
Indiana	17	Texas	3,542
Kansas	205	Utah	71
Kentucky	27	Wyoming	392
Louisiana	2,456	Fla, NY, Pa, W. Va.	57
Michigan	35	Other	2
		U.S. Total	9,459

(Region VIII States underlined.)

TABLE 7

U. S. Marketed Production of Natural Gas
1972 (Preliminary)

State	(million cubic ft/day)	State	(million cubic ft/day)
Alaska	367	Nebraska	12
Arkansas	461	New Mexico	3,230
California	1,514	New York	6
Colorado	308	North Dakota	89
Illinois	7	Ohio	225
Kansas	2,451	Oklahoma	4,717
Kentucky	218	Pennsylvania	218
Louisiana	22,757	Texas	23,662
Michigan	91	Utah	104
Mississippi	293	Virginia	7
Montana	105	West Virginia	686
		Wyoming	888
		Others	10
		Total	62,426

(Region VIII States underlined.)

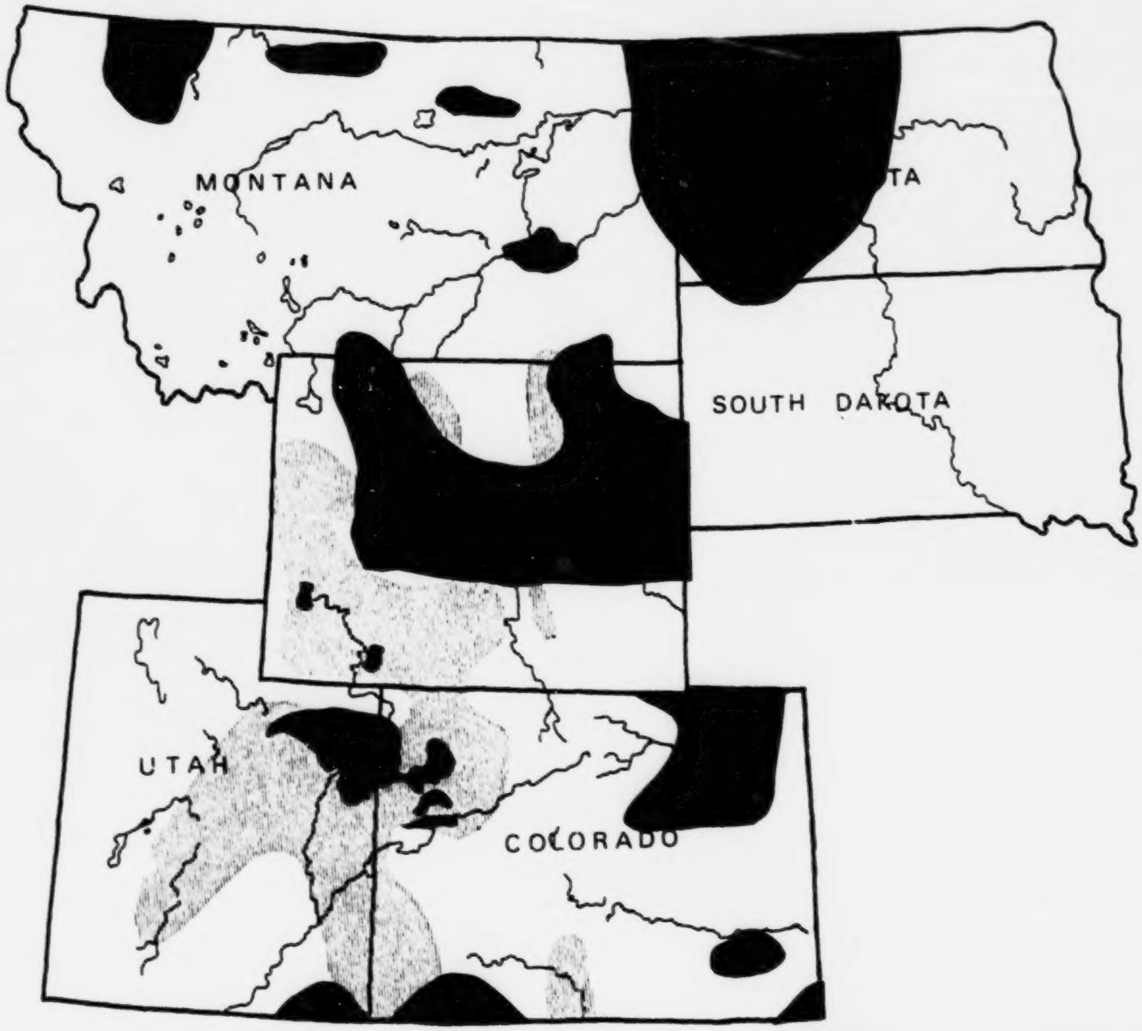
MONTANA
TA
SOUTH DAKOTA
UTAH
COLORADO
■ OIL AND GAS FIELDS
▨ "TIGHT GAS" RESERVES

FIGURE 8

General Location of Oil and Gas Reserves in Region VIII States

The U. S. Atomic Energy Commission (USAEC) has planned, along various time schedules, a series of field tests of nuclear stimulation methods to free this tight gas. Three such experiments have been conducted: Project Gasbuggy in New Mexico and Projects Rulison and Rio Blanco in Colorado. The next experiment considered is Project Wagon Wheel in Wyoming. All such applications have had questionable degrees of success to date. Recent projections show that the USAEC still has in mind a basin-wide "Full Commercial Application" of nuclear-assisted gas production in 1983.[9]

Geothermal Resources

Figure 9 indicates the large area of Region VIII in which a potential for geothermal energy resources appears best. Geothermal activity in the region is rapidly increasing. A federal lease sale is planned in Utah for FY 74. State leases are also being offered in Utah. The National Science Foundation has a geothermal exploration experiment, consisting of drilling a deep well in an area of high heat flow, underway in Montana. Considerable interest in Federal leasing has been expressed in Utah, Montana, Colorado and Wyoming. The region does, along with the far western states, contain the majority of the United States geothermal energy potential in concert with the relatively youthful age of its geologic processes.

Hydroelectric Energy

Hydroelectric power supplies about 3.9 percent of the nation's energy demand or 15 percent of the nation's electrical demand. As of 1 Jan 1972, it was estimated that the Mountain States[10] had an "undeveloped installed capacity" of 26,200 megawatts or 21 percent of the total undeveloped capacity of the United States. Estimates by major drainages show the combined total "undeveloped" capacity of the Colorado River and Missouri River Basins to be about 13,900 megawatts or 11 percent of the total undeveloped capacity of the U. S.[10]

Coal in the Northern Great Plains

The predominant conventional fuel extant in the northern part of Region VIII is coal. Of the 1.6 trillion tons of reserves estimated to be in the six-state Region VIII, 1.4 trillion tons are in the four states of the Northern Great Plains (Montana, Wyoming, North Dakota, South Dakota). Coal Production from Northern Great Plains States in 1973 has

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9. Summary Attachment to The Nation's Energy Future -- A Report to the President of the United States -- 1 Dec 73, USAEC (Item A-2, under "Increase Petroleum and Natural Gas Productions")

10. Includes Region VIII States plus Nevada, Arizona, New Mexico, Idaho and less the Dakotas. From Energy Facts, Subcommittee on Energy of the Committee on Science and Astronautics, U. S. House of Representatives, Ninety-third Congress, November, 1973.

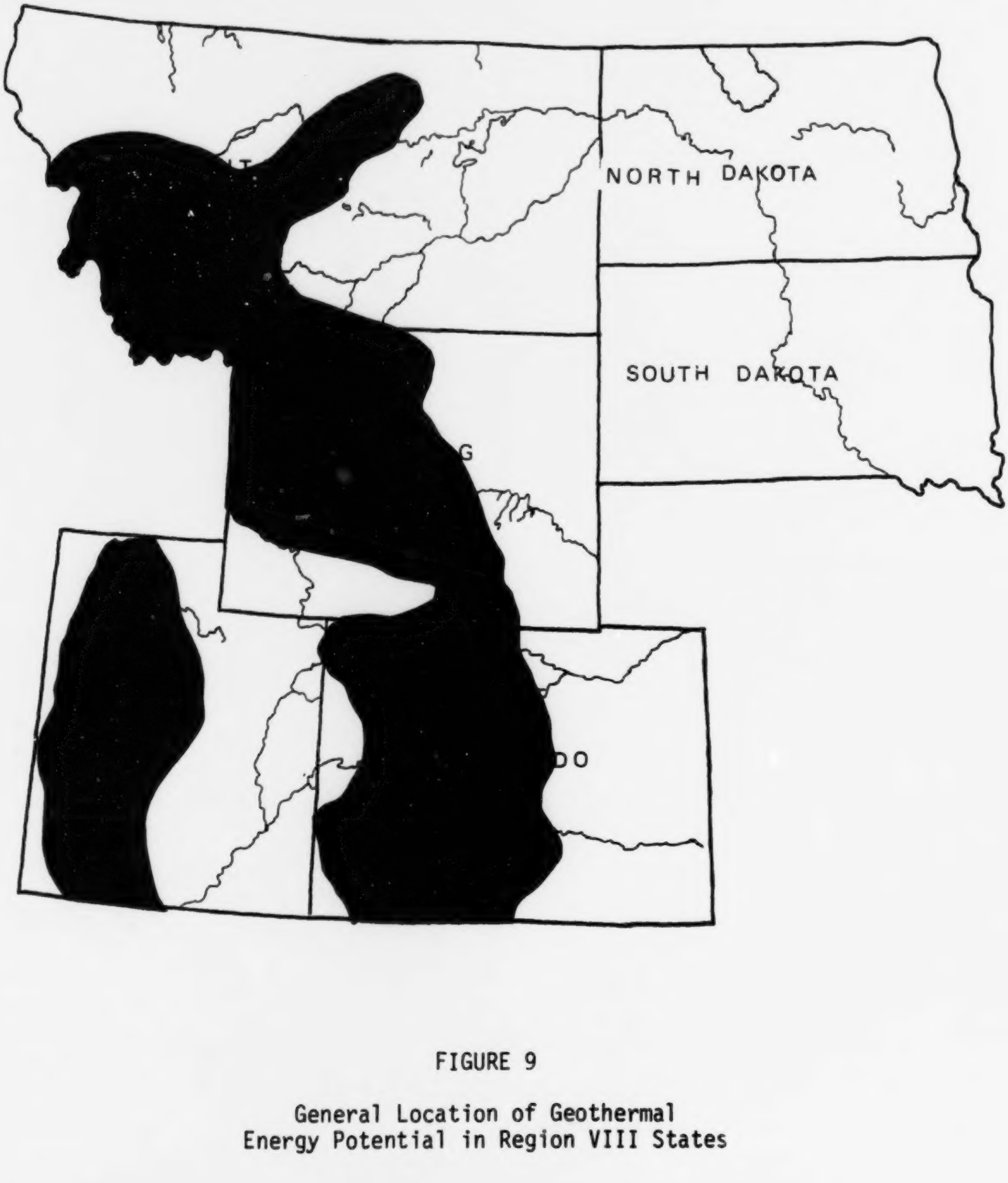
NORTH DAKOTA
SOUTH DAKOTA
G
DO

FIGURE 9

General Location of Geothermal
Energy Potential in Region VIII States

been estimated to be 16 million tons per year from Montana[11], 15 million tons from Wyoming[12], and 7.5 million tons from North Dakota[13]. Projections have been made to the effect that by 1980, Montana production may rise 400 percent to 64 million tons per year, Wyoming production may rise 360 percent to 54 million tons per year, and North Dakota production may rise 560 percent to 42 million tons per year.[14]

Most of these coals are sub-bituminous (range in heating value from 8300 BTU's per pound to 11000 BTU's per pound) and lignites (less than 8300 BTU's per pound[15]). They are contained in or near the Fort Union (geologic) Formation, which, by its extensive lateral extent, comprises perhaps the largest coal basin area within one Nation in the world. Sulfur content of these coals is often less than one percent, though contents as high as 2.4 percent have been reported recently.[16] The coals are projected as serving to help meet the requirements for cleaner burning fuels -- an important objective of the Clean Air Act.

In 1971 and 1972, the U. S. Department of Interior — Bureau of Reclamation issued two reports[17] which projected the potential growth possibilities for energy production in the Northern Great Plains. Forty-two potential power plant sites were selected by the writers where coal and water resources were considered adequate for the generation of a cumulative total of 200,000 megawatts of power. An "interim" production level of 50,000 megawatts by the year 2000 was also projected. For comparison, the current production of power from the Northern Great Plains is approximately 3,000 megawatts. Existing,proposed coal-fired power plants in the Northern Great Plains are located in Figure 10. Two indicators of the growth potential of the area are the 1,500 megawatt Jim Bridger plant under construction in southwestern Wyoming and the construction of the first 660 megawatts Montana Power Company has planned for Colstrip. Montana Power contracted with Westinghouse Electric Corporation to prepare an environmental report or assessment for an increase of the total generating capacity at Colstrip to 2,060 megawatts

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11. Coal Development in Eastern Montana: Report of the Montana Coal Task Force. January 1973.

12. Wyoming Geological Survey statistics

13. Interpolation from NGPRP National Energy Considerations Report - intermediate scenario.

14. NGPRP high development scenario projections.

15. Economic Mineral Deposits; Bateman, Alan M.; John Wiley & Sons, N.Y.,NY 1950.

16. Big Sky EIS, U.S. Dept. of Interior, Geological Survey, Oct. 25, 1973.

17. North Central Power Study (1971) and Bureau of Reclamation Appraisal Report on Montana & Wyoming Aqueducts (1973).

EXISTING AND PROPOSED ENERGY GENERATION FACILITIES IN THE NGPRP STUDY AREA

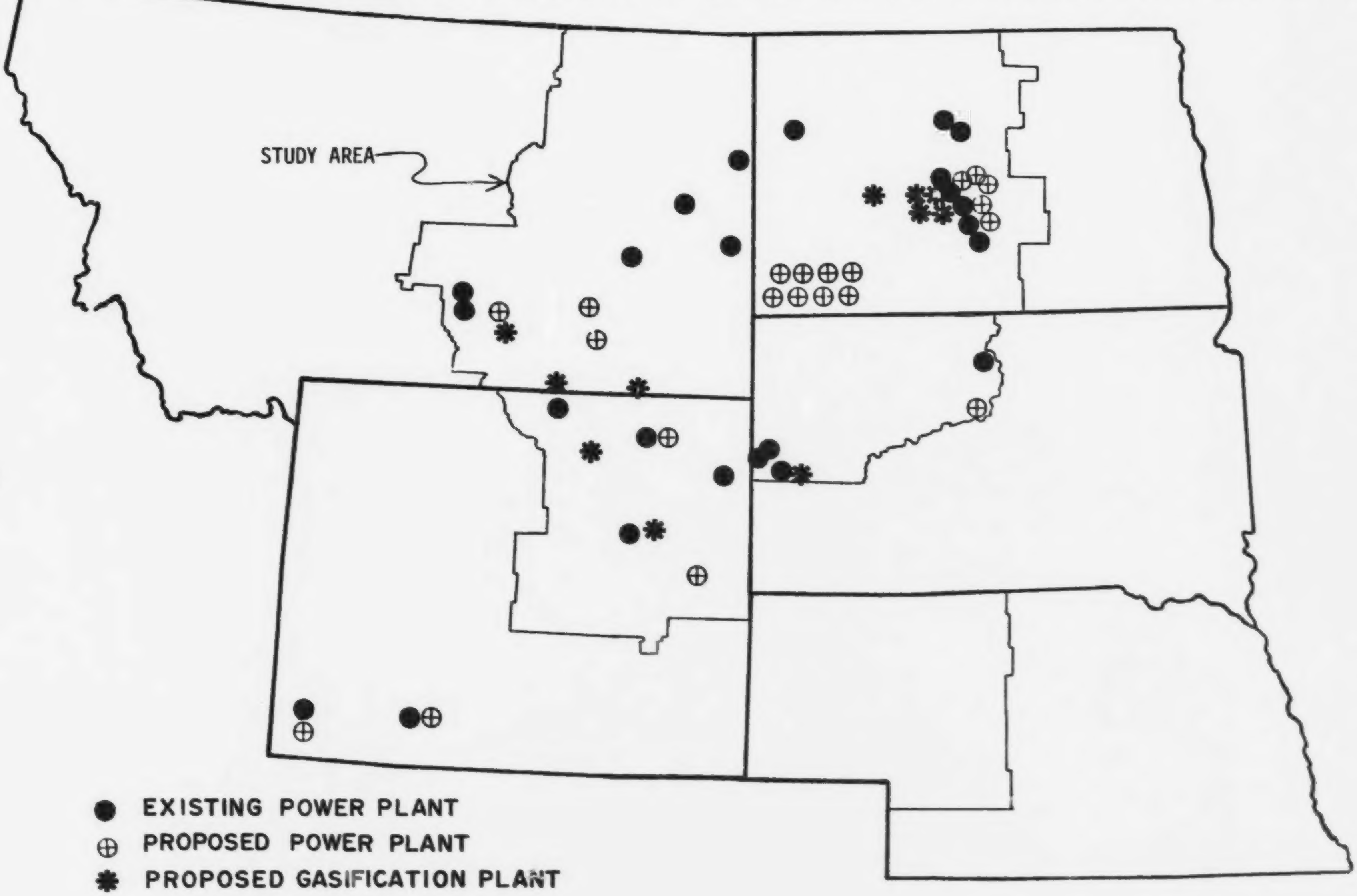
STUDY AREA
● EXISTING POWER PLANT
⊕ PROPOSED POWER PLANT
✱ PROPOSED GASIFICATION PLANT

FIGURE 10

by 1979. At this capacity it would compare in size to the 2310 megawatt Navajo Power Plant near Page, Arizona. It would appear that with the capability to produce up to 8 million tons of coal per year, the Colstrip Western Energy Mine would displace the Navajo mine at Fruitland, New Mexico as the largest coal mine in the United States.

The projections of the aforementioned reports assumed that an annual production rate of eight billion tons of coal and annual usage of up to 900,000 acre feet (1.1×10^9 m^3) of water would be required to sustain an electrical production capacity of 50,000 megawatts. These reports investigated and reported favorably on the feasibility of diverting approximately one-third of the average flow of the Yellowstone River to the coal deposits for use at the mine-mouth power plants in eastern Montana and northeastern Wyoming.

So called "full-scale" development on the order of magnitude projected above could precipitate a seven-fold increase in population in the coal-rich areas of Montana and Wyoming. The social and cultural consequences of such "development" challenge accurate description and evaluation.

The four-state area of the Northern Great Plains coal deposits as well as the six-state area of Region VIII is relatively "undeveloped" in the conventional sense of the word. When these six states are combined with Idaho, New Mexico, Arizona, Oregon, and Washington, one delineates an essentially agricultural and recreational environment with sparse population as opposed to one in which urbanization and industrialization prevail. For example, the average population per square mile in eastern Montana and northeastern Wyoming is 1.4 people per square mile. This compares with an average of 56 people per square mile for the entire United States. Figure 11 is a population density map of the NGPRP study area. The environment in this area is one of the least polluted and abused in the nation, representing very important environmental values that will continue to increase in importance as the nation becomes more populated and urbanized and as people continue to demand unspoiled environments "elsewhere." Thus, it is impossible to correctly represent environmental matters in these states in terms of kilometers of streams contaminated or cubic meters of air to be cleaned up. Rather, we must speak in terms of prevention of contamination -- prevention of not just water and air contamination, but also prevention of land disturbance, ground water contamination, and aesthetic degradation.

In order to prevent environmental contamination and to minimize the unwanted impacts of the coal development that is already underway or is presently permitted on over 1,300,000 acres (5×10^5 hectares) of the area[18]

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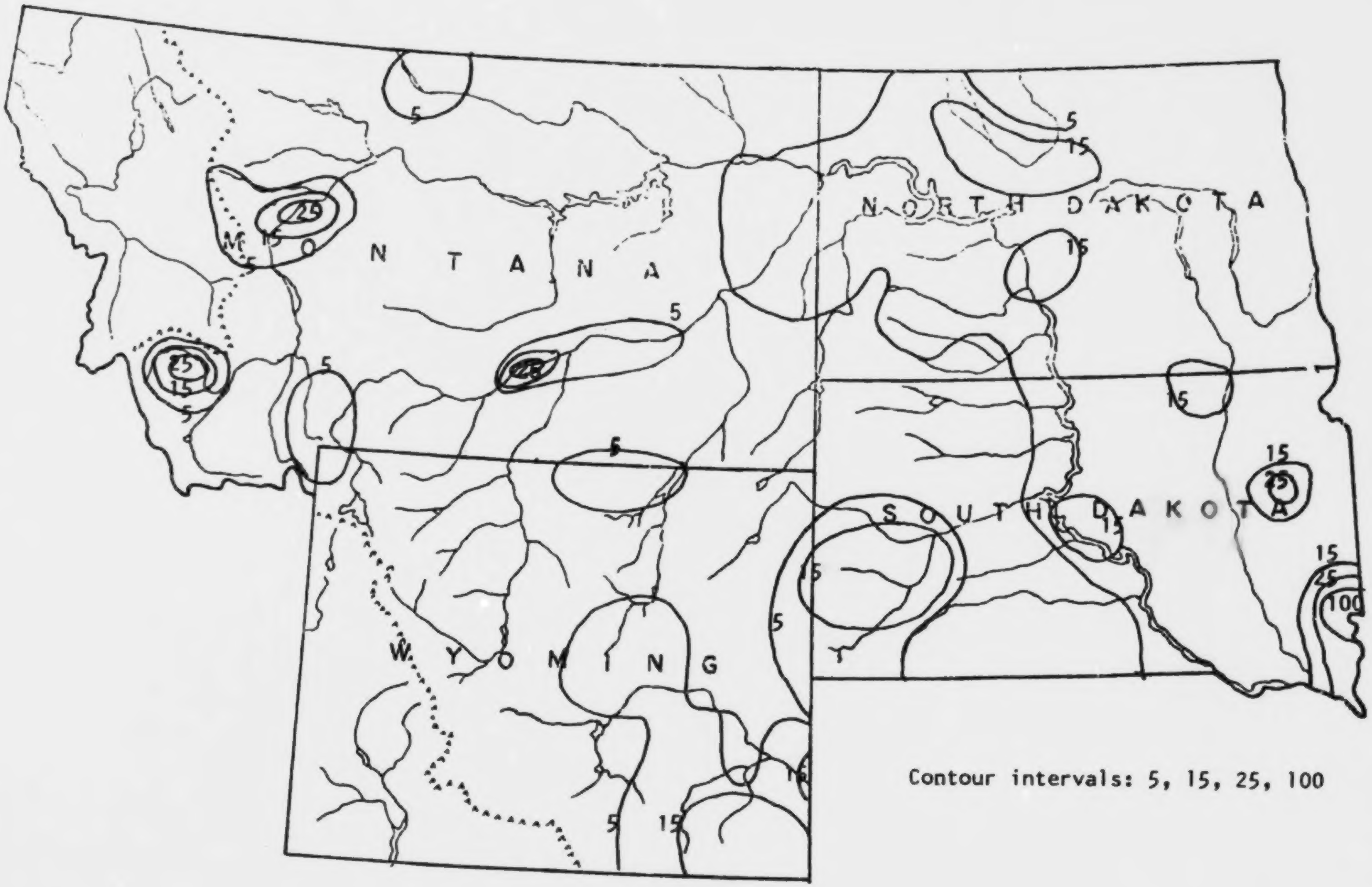
[18] The Bureau of Land Management has awarded permits and leases for Fort Union coals on in excess of 320,000 acres (1.3×10^5 hectares) of public lands for coal exploration and development. The Bureau of Indian Affairs has leased over 16,000 acres (6.5×10^3 hectares) and issued exploration permits for over 500,000 acres (2×10^5 hectares) on the Crow and Northern Cheyenne Indian Reservations. State leases total over 490,000 acres (2×10^5 hectares).


MONTANA
NORTH DAKOTA
SOUTH DAKOTA
WYOMING
5
15
25
100

Contour intervals: 5, 15, 25, 100

FIGURE 11. POPULATION DENSITY 1960 - PEOPLE/SQUARE MILE

in the Northern Great Plains and more lands in the States of Colorado, Utah, Arizona, and New Mexico, it is necessary to prescribe solutions to problems of air and water pollution in the very near future. In order to achieve an orderly "development" of potential energy resources, we must be able to properly estimate energy demands, modes of energy supply, and total potential environmental impacts of various levels and modes of production. With respect to the coals occurring in the Fort Union Formation of Montana, North Dakota, South Dakota, and Wyoming, the only estimates of the factors given previously have been prepared by organizations dedicated to supplying a demand through development of resources.[19] No public or conservation-oriented, or broad based state, Federal, or local participation in developing estimates had occurred prior to the Northern Great Plains Resources Program. Insufficient consideration had been given to the possibilities of conserving energy or to controlling the demand for energy prior to the 1973 restrictions on crude oil imports.

There are numerous unknowns to be considered when speaking of coal and power development in the Northern Great Plains, not the least of which is whether the people want such development, and if development is desired, how development should be conducted. The amount of water available for use in cooling is really unknown. The best type(s) of cooling for power plants in the area has not been determined to everyone's satisfaction. The advantages or disadvantages of developing power from other fuels found in the area have not been identified ... should power be produced in the region for distant areas? ... should coal be exported? ... the questions are numerous.

We believe that there is a need to provide these types of data to the decision-making entities of the Northern Great Plains Region such that choices relating to coal development can be made based on data and documented preference, not just on best estimates and piecemeal decisions. We believe that the Northern Great Plains Program has and can continue to serve as the vehicle to generate and collate data for this purpose. It has been important to act while the moratorium still existed against the issuance of additional prospecting permits for coal.[20]

Need for Regional Participation in the NGPRP

The credibility of Region VIII and the agency as a whole rests on the positive actions and decisions we make to become involved in major efforts of investigating the planning and management of regional energy resource development. Our past experience indicates the relative ease of preventing problems from occurring as opposed to remedying the harmful effects once the problem has surfaced. Long-term and large-scale resource development in Region VIII will prove no exception.

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[19] North Central Power Study (1971)

[20] Federal Register, Tuesday, February 20, 1973, Doc 73-3175 - order effective February 13, 1973 and "until further notice". Order No. 2952.

The Northern Great Plains Resources Program (NGPRP) has provided an important opportunity for regional participation that has become the format for environmental protection and environmental planning throughout the region as energy resource development occurs. In addition to assuring maximum regional and local input to the study, regional participation will aid ongoing programs by facilitating and promoting day-to-day contacts with the involved states, affected industries, and local interests. In effect, a Program like the Northern Great Plains Resources Program serves to multiply the effectiveness of all participants by identifying the experts and focusing their efforts on subjects of greatest import and makes the raw data as well as the results available to all parties. This regional office has received correspondence from the States of Montana, Nebraska, North Dakota, South Dakota, and Wyoming, and public groups such as the Wyoming Audubon Society requesting assistance in areas such as air quality monitoring, diffusion modeling, and trace element analysis of coals. During the first year of our efforts, we have tried to respond, within our capabilities, to all such requests. Subsequently, sections of the plan will address our responses more thoroughly. Since new power plants will continually generate interest in these areas, we anticipate that many NGPRP-initiated programs will be continued past the study's formal conclusion as integral parts of the EPA's programs and as integral parts of programs at all levels of government. While in many respects the NGPRP resembles the Southwest Energy Study[21], it differs from it in the sense that considerable development had already occurred in the Four Corners area at the time of the Southwest Energy Study's inception. The NGPRP's analytical look is occurring much earlier in the decision-making process. Conceivably, for this reason alone, the NGPRP may make a greater impact than the Southwest Energy Study on the planning, development, and management of energy resources. In addition, whereas the Southwest Energy Study used only existing data, the NGPRP has and will continue to acquire the necessary information to fill any gaps in the presently available data. The NGPRP must also facilitate public participation in all stages of the Program's efforts. (Appendix 2)

The Program may also serve as an example for a methodology that adequately addresses and provides information on oil shale development. The regional office is extremely interested in that potential since all presently economically-recoverable oil shale reserves of the United States lay within the Region.

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[21] The stated purpose of both studies is to develop an information base to guide decision-makers and to identify new data needs and alternatives for coal development in the west.

The remainder of this document is organized as follows:

Section II describes a brief history and organization of the NGPRP.

Section III presents the objectives of EPA involvement in the NGPRP.

Section IV is an Accomplishment Plan detailing regional resource needs and accomplishments to date. The needs are based upon our best estimates as to the total work to be done and the regional input required to satisfactorily affect the final outcome of the Program. Allocation of lesser resources has the danger of weakening our chances of influencing the course of the Program. Lesser support offers a sound basis for the Agency to reevaluate its positive position on participation in the study. Lesser participation would not allow EPA to do an adequate job and yet would erroneously lead outsiders to believe that we had done our job. A great deal of technical effort is required to understand the meaning of coal and other resource development. Thus a significant effort is required. In certain instances this Plan identifies activities and contract funds that are necessary to accomplish the objectives. Though it will be appropriate for EPA to continue to allocate monies and conduct activities, every effort is being made to perform the activities in close cooperation with and with monetary support from the other Program participants.

Section V is a brief summary.

II. Northern Great Plains Resources Program:

Its Evolution and Present Framework

The increasing interest and activity directed at this region's energy resource development and the large number of applications pending for permits to explore, lease, and develop the coal reserves of hundreds of thousands of acres of state, Federal and Indian land prompted Region VIII to draft letters to Secretaries Morton and Butz (Interior and Agriculture), calling for a comprehensive and systematic study of coal development in the Fort Union area. The Administrator of EPA signed these letters on March 24, 1972. Secretary Butz responded on May 2, agreeing to the need for such a study. He suggested that other minerals be investigated and also to include in the study areas such as national energy requirements, environmental protection, and land use.

Secretary Morton's reply of July 27, 1972 expressed a similar interest and indicated Interior's proposal for a joint Federal/State management plan to be used in land use and coal development decision-making. Meetings involving EPA, Agriculture, Interior, and Commerce (through the Old West Regional Commission) officials on July 28, and August 9 and 10, led to an agreement between the agencies to initiate a Federal/State task force to investigate the economic, environmental and social impacts associated with large-scale mineral resource development, primarily coal, in the States of Montana, Wyoming, North and South Dakota. Nebraska was added to these states because it was a member of the Old West Commission. A Program Review Board at the Assistant Secretary and Governor level was formed to provide coordination and policy leadership for the study. The Board created a Program Management Team to develop an outline for this Northern Great Plains Resources Program and to supervise matters on a day-to-day basis. This group consists of representatives from EPA, Interior, Agriculture, Commerce, and the States of Montana, Wyoming, North and South Dakota, and Nebraska. The organizational format of the Program is represented in Figure 12.

Framework of NGPRP

The Program Management Team released a final outline for the plan of the NGPRP in January 1973. A description of the Program's framework follows. The text of the Plan Outline of the NGPRP is included as Appendix 1.

Objectives of NGPRP

The objectives of the NGPRP are three-fold:

1. To provide data and analytical models enabling assessments of the consequences of various courses of action to be made.

2. To bring together Federal, State and local groups concerned with the planning and management of this region's energy resources. The aim is for a coordinated regional planning program.

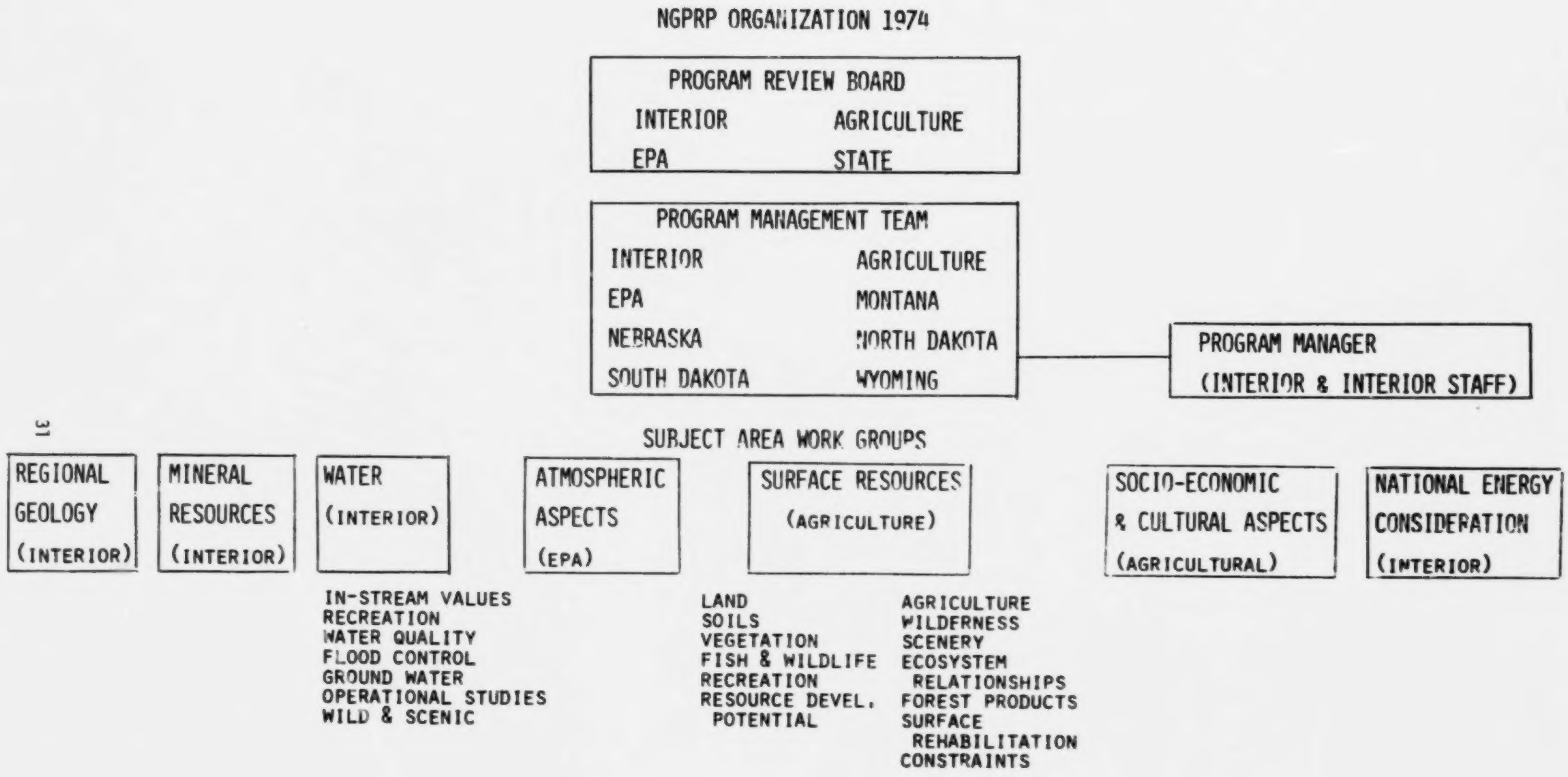
NGPRP ORGANIZATION 1974
PROGRAM REVIEW BOARD
INTERIOR
AGRICULTURE
EPA
STATE
PROGRAM MANAGEMENT TEAM
INTERIOR
AGRICULTURE
EPA
MONTANA
NEBRASKA
NORTH DAKOTA
SOUTH DAKOTA
WYOMING
PROGRAM MANAGER
(INTERIOR & INTERIOR STAFF)
SUBJECT AREA WORK GROUPS
REGIONAL GEOLOGY (INTERIOR)
MINERAL RESOURCES (INTERIOR)
WATER (INTERIOR)
IN-STREAM VALUES
RECREATION
WATER QUALITY
FLOOD CONTROL
GROUND WATER
OPERATIONAL STUDIES
WILD & SCENIC
ATMOSPHERIC ASPECTS (EPA)
SURFACE RESOURCES (AGRICULTURE)
LAND
SOILS
VEGETATION
FISH & WILDLIFE
RECREATION
RESOURCE DEVEL. POTENTIAL
AGRICULTURE
WILDERNESS
SCENERY
ECOSYSTEM RELATIONSHIPS
FOREST PRODUCTS
SURFACE REHABILITATION
CONSTRAINTS
SOCIO-ECONOMIC & CULTURAL ASPECTS (AGRICULTURAL)
NATIONAL ENERGY CONSIDERATION (INTERIOR)

FIGURE 12 NGPRP ORGANIZATION
MARCH 1974

3. To promote the exchange of information between organizations that have common activities such as data collection, research, planning, etc.

These three objectives are all to be achieved in the context of providing an "analytical and informational framework for policy and planning decisions at all levels of government."[22]

Program Sections

The NGPRP is divided into five principal "Sections" or phases as follows:

1. Program design
2. Regional profile
3. Constraints and alternate strategies
4. Analysis of consequences, and
5. Preparation of final report

These Sections are further described below.

1. Program Design:

After Federal, state, and local groups had an opportunity to comment on the NGPRP outline, the Work Groups were formed and essentially enlarged the Program Design to enumerate specific data, research, and study needs. Comments from the public, as well as other non-government groups, were solicited. This Regional office has stressed the need for public participation throughout the course of the study. The Southwest Energy Study was criticized for insufficient public participation,[23] and we must avoid making this mistake during the course of the NGPRP. Region VIII drafted a set of recommendations concerning public involvement in the NGPRP (these recommendations appear in the Appendix), which were forwarded to the Program Management Team.

2. Regional Profile

Data were collected and analyzed to give a profile of the region's mineral, air, water and surface resources; baseline environmental quality; and social, economic and cultural attitudes. The results of this effort will be finalized, in interim form, during April and June of 1974. Certain groups have acquired new data, others have been limited to existing data, and still others are starting to collect new data.

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[22] Program "Outline of Plan", Appendix 1.

[23] Rocky Mountain Center on Environment ("ROMCOE") letter dated March 16, 1973 to J. W. Larson, Interior, from R. P. Hansen, A. G. Melcher, and K. Fletcher.

3. Constraints and Alternative Strategies:

Prior to the enumeration of possible alternative strategies for the region, preliminary studies of legal, environmental, air, water, institutional, social, economic, and physical constraints operating in the area were in the form of "Constraints Reports." These reports are included in the interim reports of each work group. Then alternative strategies were considered --- alternative strategies such as no further development or "base development"; different rates and intensities of additional coal development in the form of "intermediate" and "extensive" development, all including mine-mouth power generation, shipping coal outside the region, gasifying coal, development of other energy and mineral resources, in varying degrees. In addition, strategies such as required legislation and changes in leasing policies will also be considered.

4. Analysis of Consequences:

Models and analytic methodologies will be developed to assess the environmental, economic and social impacts of the various strategies and courses of action developed in the previous section.

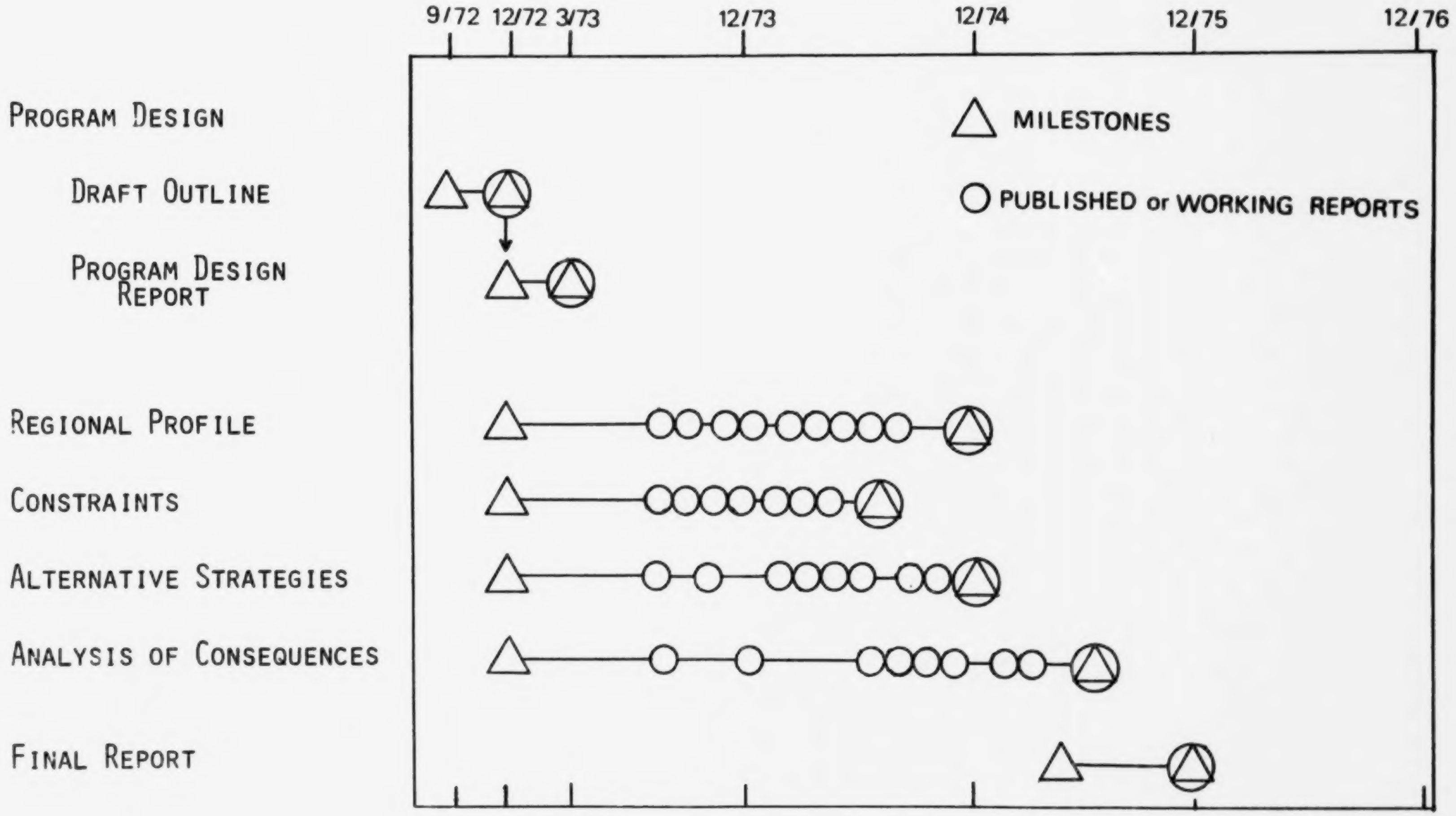
5. Final Report:

A final report compiling the results of all studies and investigations will be written. However, data and interim reports will be available to decision-makers as they are generated in the course of the study. A major interim report for June, 1974 is scheduled. Special topic reports, such as cooling alternatives for power plants, coal gasification technology, etc., will also be published in 1974.

The NGPRP will operate under an approximate three year time frame. The program sections will be time-phased, and each will not necessarily last for the entire duration of the study (see Figure 13). Activity time frames are discussed in Section IV, the Accomplishment Plan.

Significant and considered deliberations are presently under way to determine the future of the Northern Great Plains Resources Program. The Program agreed to by the primary Federal participants (Agriculture, EPA, and Interior) was scheduled for three years (1972-1975). The Program started its technical deliberations in mid-1973 and determined that an interim report would be required in June of 1974. In late 1973, it became apparent that some of the participants had not planned to continue with the Program after the June, 1974 report.

Recent (February, 1974) deliberations have reindicated strong support by members of the Program Management Team to continue the Program in essentially its present format, with an increased role in coordination of pertinent energy research and development.



Schematic Representation of Interagency NGPR Program
As Initially Proposed

Times Shown are Tentative Pending Further Work

FIGURE 13

It is this regional office's view that the Program should be continued in essentially its same format for one more year -- through June of 1975, and then would phase out its activities during the following fiscal year 1976 (until June of 1976).

EPA, from its Region VIII staff, leads (L) the Atmospheric Aspects Task Group (Figure 14) and the Water Quality Aspects Subgroup of the Water Task Group; participates (P) in the Mineral Resources, Surface Resources, National Energy Considerations Task Groups; and contributes (C) to the Socio-Economic and Cultural Aspects Task Group. Some input was supplied to the Regional Geology Task Group.

Task Group Leaders and their affiliations are listed below:

A.	Regional Geology	Dick Keefer (USGS - Denver)
B.	Mineral Resources	Bill Parks (USBM - Denver) Doss White
C.	Water	Phil Gibbs (BR - Billings) (Robert Hagen, Jim Shaw EPA-Denver, Water Quality Aspects)
D.	Atmospheric Aspects	Louis Johnson (EPA - Denver)
E.	Surface Resources	Otis Copeland (USDA - Ogden)
F.	Socio-Economic and Cultural Aspects	Frank Osterhoudt (USDA - D.C.)
G.	National Energy Considerations	James A. West (Interior ASMR-D.C.) Walter Dupree

Status of Work Groups

All Work Groups have worked toward the objectives of issuing interim reports during April of 1974 and contributing to the Interim Report of the Program as scheduled for June of 1974. Most Groups have uncertain pictures at this time, due to lack of direction of the Program Review Board as to their future role.

III. Objectives of EPA Involvement in the Northern Great Plains Resources Program

Objectives

In Sections I and II, the need for and purpose of the Northern Great Plains Resources Program was discussed, both directly and indirectly. The objectives of the Program are necessarily diverse, since the interests of many sectors are represented. This Accomplishment Plan is, however, directed toward the Environmental Protection Agency's participation in the program and, in particular,

Read numbered blocks for program sections. Read successive blocks of lettered columns for work group title, proposed group makeup and type of subject matter addressed.			PROGRAM SECTIONS			
SUBJECT AREAS	PRINCIPAL AREAS OF INTEREST	AGENCY PARTICIPATION*	SUBJECT MATTER CONSIDERED			
			1 Regional Profile	2 Constraints on Changes	3 Strategies for Change	4 Analysis of Consequences
A Regional Geology	Land form Topography Geology	L-GS P-USDA, States C-BLM, EPA	Scale-Coverage	Slope Stability Surface hydrology		
B Mineral Resources	Coal Oil & Gas Uranium Other	L-BM P-BLM, EPA, USDA, BR, GS, States, Industry, Priv. Org. C-AEC	Location & depth Grade Ownership & control Trace elements	Mineability Ownership, leases Reclamation laws Demand Attitudes Alternative conversion	Mining methods Extraction & exportation Local processing Local energy conversion Local industrialization No development	Consumption vs. Conservation Ground water
C Water	Surface Sub-surface	L-BR (Supply) P-EPA (Quality), GS (Basic data), MRBC, BSF&W, BLM, USDA, COE, NPS, States, Priv. Org. C-BOR	Quantity Quality Current & projected use (current plans) Impact on in-stream needs	Rights Compacts Quality & quality standards Location Attitudes	Surface development alternatives Ground water management alternatives Interbasin diversions No development	Consumption vs. Conversion Quality
D Atmospheric Aspects	Compositional & Regional dynamics Control technology	L-EPA P-NGAA, States, Priv. Org. C-USDA, DOI	Climate Quality Meteorology of trace elements	Quality Standards	Alternative point source locations Export No degradation	Regional quality pollutant dispersion patterns
E Surface Resources	Soils Vegetation Timber Grassland Other Fish & wildlife Recreation Agriculture Scenery Wilderness Reclamation	L-USDA-FS P-BLM, BOR, BSF&W, EPA, NPS, States, Priv. Org. C-BLM, COE	Location Production Current use Ownership & control Zoning Reclamation	Ownership & control Economic Biological & physical Attitudinal Zoning	Continue current practices Accelerate selective development Mixes of alternative development No development	Interference from other developments Preservation/Conservation Consumption Reclamation
F Socio-Economic and Cultural Aspects	Existing local and regional economy Social institutions Attitudes Archeology & history Aesthetics	L-USDA-ARS P-USDA, DOC, HEW, BIA, BLM, NPS, EPA, States, Indust. Private Org. C-BOR, HUD, DL	Location Distribution Importance Life styles Labor force	Attitudes Physical constraints on change Economic constraints on change	Continue current status Accelerate selective development Mixes of competing needs No change	Preservation of current life style & values Growth of population & economy with possible disruptions & losses
G National Energy Considerations	Energy supply and demand Energy technology "Scenario development"	L-DOI (Energy Office) P-EPA, DOC, FPC, AEC, USDA, BR, BLM, BSF&W C-OST, OEP, Indust.		Current & projected energy Technology National & Regional energy Fuel situations	Alternate regional/national energy resources development strategies and technologies No development	Satisfaction of national and regional energy and fuel damand Non-satisfaction Intermediate satisfaction

*L - Lead, P - Participant, C - Contributor

TASK MATRIX

NGPRP WORK GROUPS AND PARTICIPANTS (Modified from January 19, 1973 Version)

FIGURE 14

TASK MATRIX

The attached matrix indicates the scope and organization of the program and illustrates how work groups, organized on the basis of technical expertise, will participate in each of the four sections of the program as they are described in the draft design outline. The tasks shown on the matrix are intended to be illustrative rather than exhaustive. The work groups are designed to bring together related inventory and modelling expertise throughout the study. At the same time, the major sections of the program will be coordinated across work group lines. Staff coordinators will be in charge of each program section and may be members of the Program Management Team.

The right-hand column of the matrix indicates proposed agency assignments. Lead agencies are designated by L. These agencies will have administrative and organizational responsibilities, subject to overview by the Program Management Team, and will be full-time participants. Participating agencies are indicated by P; they also are likely to have full involvement in decision-making and report review within the area of responsibility of the work group. They will make major contributions to the work, as well as, to decision-making and review. Contributing agencies are designated by C; they will provide input to the program as appropriate and review reports within their areas of expertise.

Key to abbreviations:

AEC - Atomic Energy Commission
BIA - Bureau of Indian Affairs
BLM - Bureau of Land Management
BM - Bureau of Mines
BOR - Bureau of Outdoor Recreation
BR - Bureau of Reclamation
COE - Corps of Engineers
DL - Department of Labor
DOC - Department of Commerce
DOI - Department of the Interior
EPA - Environmental Protection Agency
FPC - Federal Power Commission
FS - Forest Service
GS - U. S. Geological Survey
HEW - Department of Health, Education and Welfare
HUD - Department of Housing and Urban Development
MRBC - Missouri River Basin Commission
NOAA - National Oceanic and Atmospheric Administration
NPS - National Park Service
OEP - Office of Emergency Preparedness
OST - Office of Science and Technology
BSF&W - Bureau of Sport Fisheries and Wildlife
USDA - U. S. Department of Agriculture

EXPLANATION FOR FIGURE 14

that participation either conducted in response to the Program or discharged as a normal responsibility toward the Northern Great Plains by the Region VIII staff of the EPA.

The fact that substantial EPA involvement in the Program is critically necessary has been previously indicated.[24] The need for strong regional representation in the EPA involvement is considered obvious. We believe that the credibility of EPA and the regional offices of EPA rests upon the positive actions, decisions, and influence we muster during the implementation of the Program.

The specific objectives of EPA involvement center upon the development, collation, and presentation of data through the use of which those decision-making entities will choose the most acceptable course of action relating to resource development in the Northern Great Plains area. Primary EPA involvement will continue to be related to those areas in which we have been directed, by law, to work; namely: water quality, air quality, radiation, solid waste, and aesthetics (the latter as addressed in the National Environmental Policy Act). We have included in Appendix 3 a statement of statutory justification for EPA participation in the NGPRP. Secondary EPA involvement has been in the broader areas that tend to have the most impact upon EPA's areas of responsibilities. These more general areas include revegetation, population growth, energy demand and supply, mining methods, wildlife and recreation values, and the choices we have between energy fuels and satisfaction of energy demand.

A major objective of EPA participation in the NGPRP is to aid Region VIII of EPA to define and evaluate its on-going environmental protection program as related to this area. The large data base, the research, and the alternatives of development, technology, and environmental impact will continue to be of immense value to Region VIII in all of its program planning and implementation processes. Techniques and analyses developed and refined here will also be of great value to other regions, particularly those in the West, in planning for environmental protection and pollution control. The value has already shown itself as oil shale and other energy fuels undergo renewed development in the West, in that our experiences with the Program give us a guide and experience for evaluating the potential development of these other fuels.

Approach or Secondary Objectives

In order to achieve our goal of following the most environmentally acceptable course of action, it is both necessary and appropriate to impact the Federal, state, and local decision-making processes and, in fact, to assure the development of such processes if they are presently absent. Such interfacing with other agencies and the public sector takes place both inside and outside the Program.

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24. An "Action Memo" dated August 3, 1972, "Mineral Development in the North Central United States" - AH (EPA)

It is necessary, because of the large geographic area under consideration for coal extraction, because of the potentially large power-generating capability, and because of the still larger area to which power may be supplied, to select those areas of the Program where EPA involvement may show the greatest return or benefit. A continuing objective will be to strengthen state and local capabilities wherever necessary so that environmentally sound development, commensurate with EPA's directives and responsibilities, is achieved. EPA will also strive to have other Program participants contribute both expertise and funds to accomplish those tasks we see as critical to the Program.

In many cases, it will be appropriate to develop arrays of data describing alternative modes of development and the results of such development. To a degree, this is "modeling." It will often be necessary to develop and refine the tools for "modeling" and then to transfer the "modeling" technique to other activities, such as other Task Groups and the states, for use.

Many tasks are and will be performed simultaneously. Many task items will be completed and reported prior to the end of the Program, in order that decisions be based upon the most current information. The organization and interrelations of the Program elements are complex and challenging. Yet, successful implementation of the tasks is critical to EPA's mandates.

In the end, the success of the Program will be determined by the public. It can, therefore, never be emphasized enough that public involvement, from the beginning, is the key to a successful Program.

Region-wide Considerations (Region VIII)

If coal development were the only development facing the Rocky Mountain Prairie Region (Region VIII), it would be possible to dedicate time and effort to the evaluation and direction of that possibility, with little concern over any other mineral resources. But the potential reserves of other energy fuels, existent in substantial amounts throughout the six-state region of Region VIII -- fuels such as oil, gas, water for hydroelectric plants, oil shale, uranium, geothermal heat, and solar energy -- make it necessary for EPA to require simultaneous consideration of most all energy fuels rather than just coal. The large cumulative total of energy fuels in the Region also makes it necessary to consider energy demand alternatives.

As the inhabitants of the region recognize, not only does this region view its scenery as a prized resource, but additional growth, in terms of more people, has a far greater potential for causing detrimental impacts on the environment in the Great Plains and Rocky Mountain area than the same growth does in the established metropolitan centers of the United States. Thus, the addition of a power plant and the support it requires and the secondary growth that it can stimulate are all major factors in the lives of the area's inhabitants.

Trans-basin diversions of water are common in Region VIII and may increase, if water-cooled power plants are constructed. Such diversions may have repercussions on agricultural development and may significantly affect efforts to control salinity. Thus, the potential for coal and power development in the Northern Great Plains could have a serious impact on water quality in the western portion of Region VIII.

Furthermore, review of the implications of resource development occurring or scheduled to occur in the Northern Great Plains can supplement the expertise already within the region, and EPA, in turn, to allow us to cope with similar developments, such as nuclear stimulation of gas on the western slope of the Continental Divide, or oil shale development.

It should be noted that the geographical boundaries of the NGPRP vary according to the subject surveyed. It is a Region VIII objective to insure that those impacts that may extend out of the immediate NGPRP area of four states be adequately assessed.

IV. DETAILED WORK ACCOMPLISHMENT PLANS

Regional Office Coordination and Management

When the regional participation in the Northern Great Plains Resources Program was proposed, it was considered necessary to have a "Regional Coordinator" of Program-related activities. The lack of such coordination in the very early stages of regional participation in the Program bore this need out. At this time, the Regional Administrator has appointed a "Regional Director of EPA Activities in the Northern Great Plains Resources Program."

More than anything else, the complex semi-technical and semipolitical nature of the Program make it imperative that a coordinating function be established, and that this function allow those with technical expertise to pursue their detailed investigations with a minimum of distraction and yet with the knowledge that their efforts are being integrated with the Program and with EPA's other activities. The Northern Great Plains Resources Program is and has been an extremely important activity in Region VIII, and it has served not only to show why large scale development of energy fuels or mineral resources can have significant detrimental impacts upon environmental quality, but also how we can go about increasing our confidence that such development can be controlled, planned, and executed in an environmentally sound fashion. Thus, the Regional Director of EPA's Program Activities has an important role to play in transferring, both to and from the Program, a comprehensive framework that properly assesses, prevents, and as a last resort controls environmental damage that may result from the development of natural resources.

The Director's office is to be staffed with sufficient expertise in the areas of energy supply and demand, earth and atmospheric sciences, and environmental problems peculiar to the West, to supplement the remaining regional functions which thoroughly cover surface water interactions, atmospheric aspects, and EPA's specific legislative authorities. The Director must have demonstrated managerial capabilities, with emphasis on a coordinating role. These capabilities are important by virtue of the fact that much of the Region VIII activities in the Program come from individuals who are not supervised by the Director and who may be in various divisions of the regional office. Further, the Director should be in a position to properly implement those activities related to the Program that have been determined to have high priority. This requires inter-divisional authority to coordinate and implement regional inputs to the Program, within the framework of inputs described in the Accomplishment Plans, as approved.

Certain individuals from the various divisional staffs will be essentially "assigned" to provide inputs to the Program. This Accomplishment Plan will make those assignments in general terms. The periods of assignment may range from a few days to months (the latter during intensive investigative efforts and large scale field work). While the activities of these individuals will not be closely scrutinized by the Director, it will be necessary for both the individuals and the Director to consult frequently.

The Director's office serves to perform selected portions of the interagency coordination required by participation in the Northern Great Plains Resources Program. The Director also serves as liaison between the Program and EPA personnel outside the Regional office, such as NERC (National Environmental Research Center) or the Division of Field Investigation personnel, who may perform activities directly for the Program, or who may be performing an activity that is closely related to the Program and that requires activity or input from within the Region.

The Director directly supervises, at this point, two positions concerned with administrative, secretarial, and clerical support. All other regional support to the Program comes from the Division-Branch-Section, or "existing" organization of the office. The Regional Director of EPA's Activities in the NGPRP may be assigned either to the Regional Administrator's staff or to the Director's office of the Air and Water Programs Division. In either case, the Regional Administrator and the Director must provide for proper functioning of interdivisional activities. It is important, in any organizational case, that all Program activities mesh with other regional activities since there is a significant amount of interface between NGPRP and other EPA activities. It is also important that a rule-by-committee approach be avoided.

The Director serves as Chairman of the regional Energy Task Force. This Task Force, in existence since late 1972, was formed by the Regional Administrator to provide a focal point for discussion and staff-level interdisciplinary coordination for all regional activities related to coal mining, power plants, oil shale, uranium, etc. The Task Force developed the first Accomplishment Plan for the Northern Great Plains Resources Program.

The Director may serve at grades equivalent to GS 14/15 and may be temporarily assigned from other EPA activities. It must be emphasized that the incumbent should satisfy some very stringent requirements for demonstrated competence in both technical and managerial fields. A strong foundation in economics, control technology, or similar fields is necessary. An established and highly regarded reputation in EPA Headquarters is desirable.

As has been the case with all participants in the Northern Great Plains Resources Program, the Director has been able to place less emphasis than is desirable on both all technical and all administrative matters that deserve attention. Throughout fiscal year 1974, the areas in which we have needed more emphasis include the following:

- Energy Conversion Technology
- Drafting
- Technical Editing
- Legislative Review
- Economics
- Sociology
- Cultural Impacts
- Geohydrology
- Geochemistry
- Agronomy
- Meteorology

There is thus a need to consider supplemental personnel support in these areas, placed either in the Director's office or in other organizational entities of the Regional office. This need is further identified in Table RD and in subsequent tables for other work activities.

In Table RD there are identified a total of 1.4 and 1.0 work years of effort for fiscal years 1975 and 1976 respectively. This includes professional, administrative and secretarial effort.

Table RD: Northern Great Plains Resources Program -- EPA Region VIII Accomplishment Plan

Task: Regional Coordination

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
1. Coordination of EPA Regional Activities conducted pursuant to the NGPRP or other entities through discussions with NGPRP or other personnel and EPA Regional Staff -- including inter-divisional direction of activities. Siting conference or seminar activities and report coordination.	0.13[a]	0.40[a] 26,000[b]	0.40[a] 21,000[b]	0.25[a] 10,000[b]
2. Coordination of responses to and solicitation of information from or participation of the public and local sectors; reporting. Managerial function with technical expertise required.		0.15	0.15	0.10
3. Chairing of Regional Energy Task Force. Task Force comprised of representatives from Division Directors' Staffs. Work Plan revisions, continuing planning effort. Managerial function with technical expertise required.	0.12	0.03	0.02	0.02

a. Work years of effort

b. Contract funds

Table RD (Continued)

Activity	Actual Activities FY 1973	Actual Activities FY 1974	Proposed Activities FY 1975	Proposed Activities FY 1976
4. Participation as primary Regional representative on Subject Area "G" Work Group, "National Energy Considerations" and other selected Work Groups as expertise dictates. Report preparation, reviews, contract monitoring. Technical expertise covering many areas required.		0.02	0.03	0.03
5. Regional planning, administration, and management of multidisciplinary activities.		0.30	0.15	0.10
6. Coordination of NGPRP Activities with similar regional activities in oil shale, uranium, geothermal, oil and gas.		0.10	0.10	0.10
7. Investigation of methodologies necessary to organize multidisciplinary data into transferable, available and useful forms.			0.05	0.10
8. Review of technical proposals and activities of Project Officer on key research projects.			0.10	0.10
9. Secretarial & Administrative Support -- Administrative Aid and Secretary-typist.		0.50	0.40	0.20
TOTALS: Regional Work Years	0.25	1.50	1.40	1.00
Regional Contract Funds		26,000	21,000	10,000

SPECIFIC WORK GROUP ASSIGNMENTS

The remainder of this section is organized in concert with the Task Matrix of the Northern Great Plains Resources Program, as presented earlier in this Plan (Figure 10). Each "Subject Area" or "Work Group Area" is treated separately. Note, however, that certain activities listed for one Subject Area include or run together with activities listed for a second or third Subject Area. Such is the nature of any multidisciplinary assessments that tries to also be interdisciplinary. Quantitative resource allotments have not, however, been duplicated over the areas.

We have not divided the EPA resource allotments into the "Program Section" divisions shown along the right side of the NGPRP Task Matrix (Figure 14), since such subdivisions tend to be difficult to use, inasmuch as many of the activities "cross" these divisions. We have, instead, utilized these divisions ("Regional Profile," "Constraints on Change", etc.) in the text or activity description wherever useful and appropriate.

The descriptions of each Work Group are based upon our knowledge of the past and present efforts, and EPA's view of each Group's future assignments. We are not aware of any detailed listing of specific assignments, nor have the detailed work plans for all Work Groups ever been collated. The Work Group assignments of activities, as shown in this Plan, have been, therefore, subject to change. Further, the future format of the Program is not now known. Certain Work Groups may not be continued past June of 1974. We should reiterate here that it is our hope and position that the Program continue with continued and emphasized support from all participants.

Various activities listed have been performed in part by groups other than EPA, and it is conceivable that the EPA resource allotments shown herein will be transferred to other activities or between Task Groups, and even reduced as time progresses, needs are better identified, and other agencies or entities make known their commitments. However, since there is, at the time of writing (May, 1974), no guarantee of what other groups will provide or assume as their future activities, EPA has attempted to present a fairly comprehensive listing of the activities it feels should be performed, and EPA has attempted to identify sufficient of its resources to assure that the most important jobs are done, either directly or indirectly by EPA.

Regional Geology Work Group

(Work Group A)

Scope of Activities

Work Group A has been assigned the task of preparing maps or other representations showing such geologic and topographic features as are felt to be important to the siting of coal mines, power plants, transmission lines, urban centers, transportation routes, and secondary industry. This Group has within its scope the production of graphical representations, in much the manner considered for Environmental Impact Statements, which will allow the evaluation of geology and topography from the standpoints of stability, strength and geologic importance.

Accomplishments

The Regional Geology Work Group, under the direction of Mr. Dick Keefer of the U.S. Geological Survey, has prepared a small scale geologic map of the Northern Great Plains area, the area as defined by the Program. The Work Group has also prepared a base map of the study area, shown in reduced size in Figure 15, for use by other Work Groups.

The effort, to date, has also included slope analysis of specific areas for purposes of planning mining and siting coal conversion facilities. Criteria for delineating slopes are based upon proposed Federal and state requirements for maximum natural slopes and high-wall reduction. (Montana's current Reclamation Law is included as Appendix 6.)

The Work Group has also demonstrated the usefulness of maps showing the expected change in surface topography after removal of coal. The preliminary maps are expressed in terms of surface contours or slope.

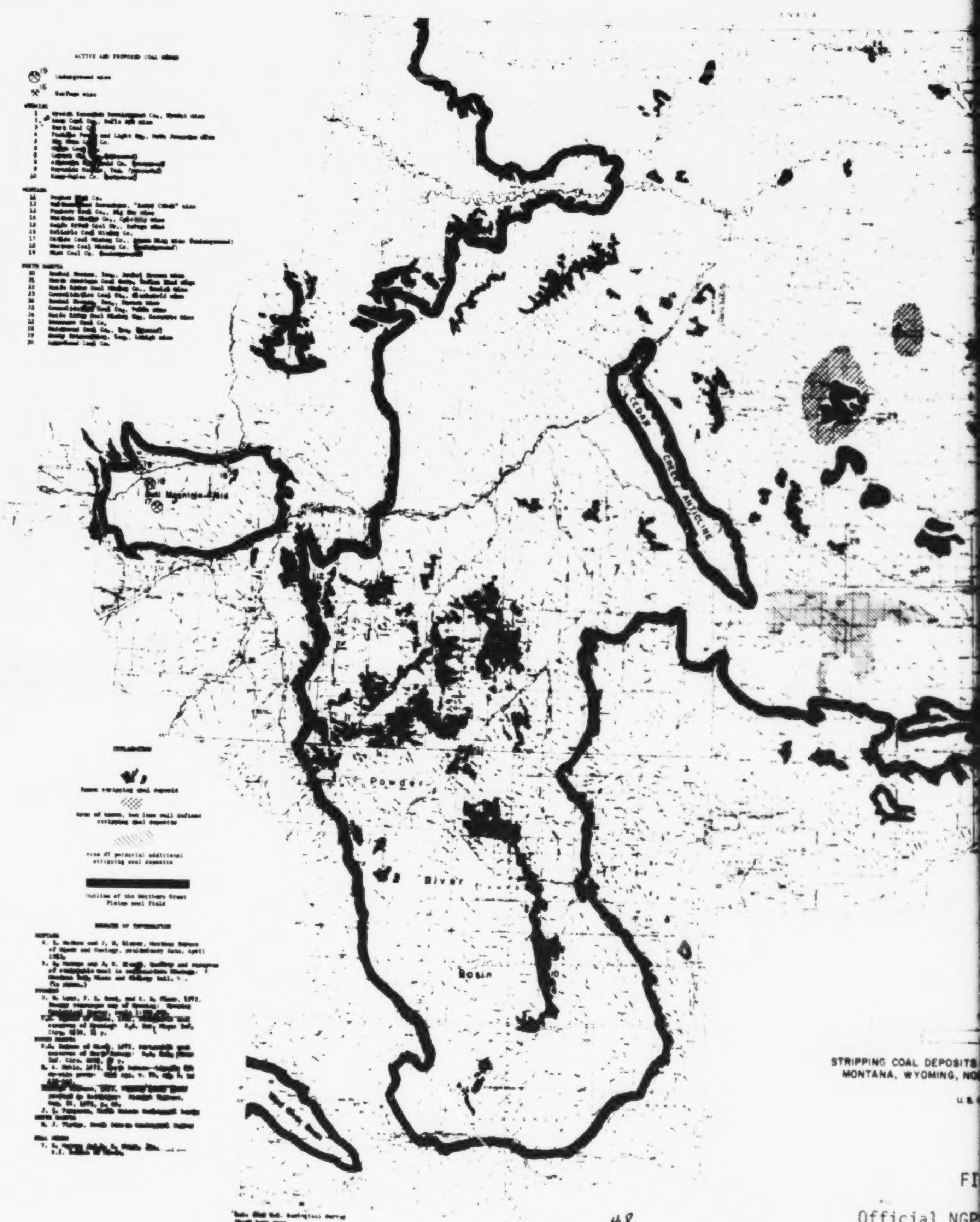
The Regional Geology Work Group has brought together some ongoing efforts of the Geological Survey directed toward a preliminary evaluation of the Madison Limestone as a potential source of water for industry in the Northern Great Plains. The results are then to be analyzed by the Water Work Group.

The Work Group has also worked closely with the Mineral Resources effort (Work Group B) in matters of identifying the coal deposits, projecting overburden thicknesses, and other items of mutual concern.

Future Activities

A great deal of basic geologic data gathering still remains to be done in the Northern Great Plains Area. Certain areas have not been

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY


ACTIVE AND PROPOSED COAL MINES
19 Underground mine
16 Surface mine
WYOMING
MONTANA
NORTH DAKOTA
EXPLANATION
Known stripping coal deposits
Area of known, but less well defined stripping coal deposits
Area of potential additional stripping coal deposits
Outline of the Northern Great Plains coal field
SOURCES OF INFORMATION
CEDAR CREEK ANTICLINE
Powder
River
Basin

STRIPPING COAL DEPOSITS
MONTANA, WYOMING, NO

FI

Official NGP

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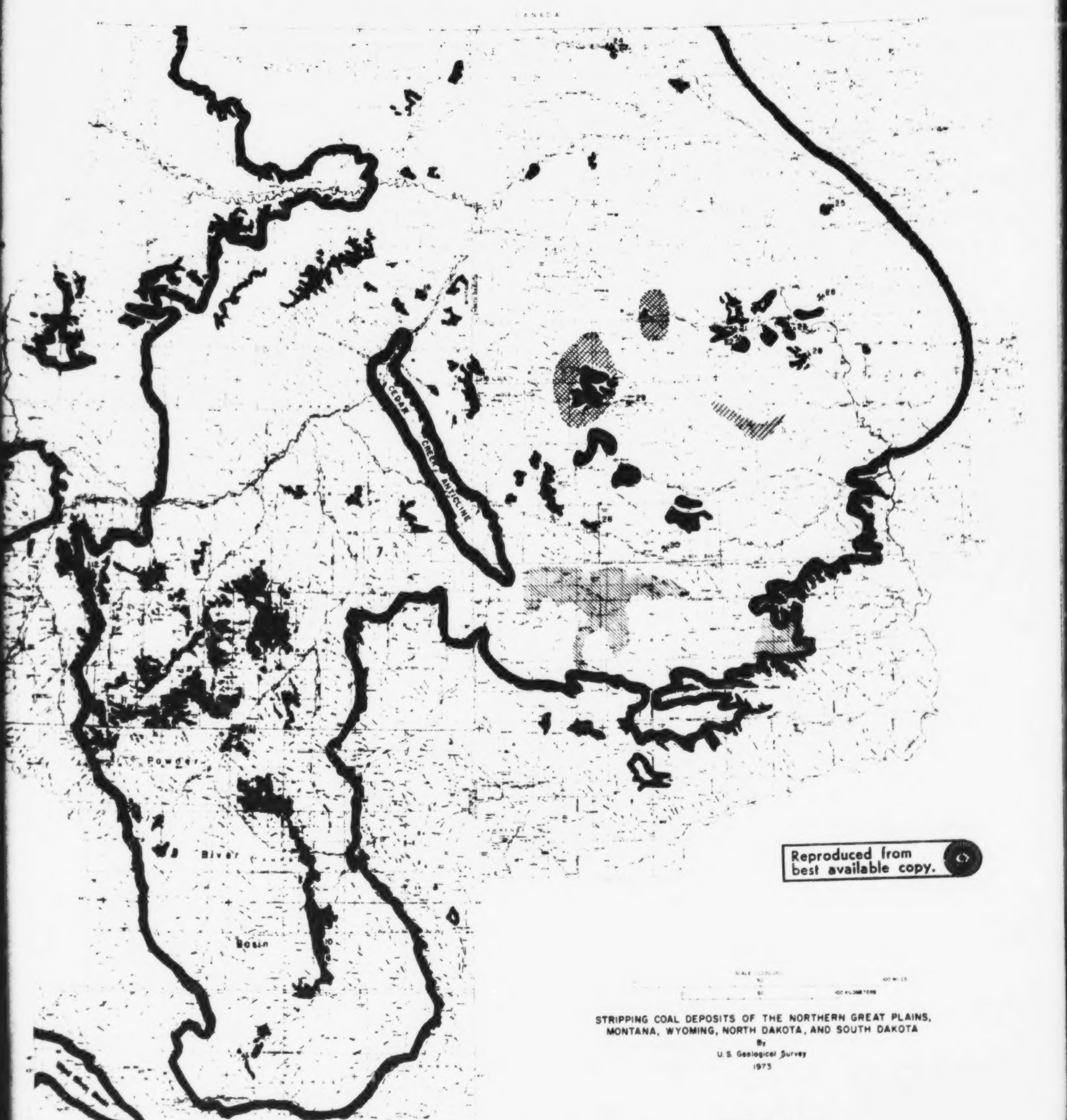

CANADA
CEDAR CREEK ANTICLINE
Powder
River
Basin
25
26
28
10

STRIPPING COAL DEPOSITS OF THE NORTHERN GREAT PLAINS,
MONTANA, WYOMING, NORTH DAKOTA, AND SOUTH DAKOTA
By
U.S. Geological Survey
1973

Reproduced from best available copy.

FIGURE 15

Official NGPRP Study Area Map

topographically mapped, existing maps are out of date, and geologic evaluations of land uses have not been made. Future activities should be directed toward mapping areas of high priority, geochemical work to ascertain chemical variations in water quality and in parent material, and detailed structural investigations. Aspects of subsurface disposal also have yet to be investigated. Efforts will also be directed to better describe and restore surface water drainage in areas of strip mining.

EPA involvement in the activity or activities related to the Regional Geology Work Group's scope of work are projected to require 0.10 work years of effort in Fiscal Year 1975, and 0.05 work years in Fiscal Year 1976. While no contract or other significant support dollars have been identified as required under this activity, monies have been requested for other work groups for activities that closely depend upon geologic factors.

To date the limited contact with the Regional Geology Work Group has been carried out by the Regional Director of EPA's Program activities. It is in this area of earth sciences that the Program hopes to receive more intraregional support during FY 75. It is hoped that renewed emphasis on earth sciences aspects of other energy fuels assessments will make available to the NGPRP this type of support.

Table A -- Northern Great Plains Resources Program -- EPA Region VIII Accomplishment Plan

Regional Geology; Subject Area "A"

Activity	Actual Activities FY 1973	 FY 1974	Proposed Activities FY 1975	 FY 1976
1. Review of Work Plan and Periodic Review of Task Group Output to insure that important parameters are evaluated and that the format(s) allow evaluation of various development routes. Insure that earth sciences data are considered in the light of the probability of secondary growth and industry, and alternative modes of power generation and resource utilization (Assure proper land use). Insure that geologic situations of aesthetic or academic importance are adequately considered. Technical function with earth sciences emphasis.	0.04	0.08	0.01	0.01
2. Investigate topography and surface drainage to determine whether adequate technology or knowledge exists to properly mine shallow coal and to restore stable, drained surface. Provide liaison in areas ground water evaluation.			0.01	0.01

Table A (Continued)

Activity	Actual Activities FY 1973	Actual Activities FY 1974	Proposed Activities FY 1975	Proposed Activities FY 1976
3. Input to evaluations of remote sensing as planning and enforcement tool for surface mining operations.			0.01	0.01
4. Input to evaluations of trace element composition of coals and surrounding materials. Establishment of geochemical patterns of soils and parent materials to in turn provide baseline information.		0.05 10,000	0.04	0.01
5. Input to assessments of impacts on ground water quality and resource caused by coal development			0.02	0.01
6. Secretarial		0.02	0.01	0.01
TOTALS: Regional Work Years	0.04	0.15	0.10	0.05
Regional Contract Funds		$10,000		

Mineral Resources Work Group

(Work Group B)

Scope of Activities

Work Group B has been assigned the responsibility of quantifying the energy fuels resources (coal, oil and gas, uranium, oil shale, geothermal, and hydro) and other mineral resources (from sand and gravel to gold) in the Program area.

The Work Group performs a very central role in the Northern Great Plains Resources Program by virtue of its expertise in evaluating the coal resource and siting coal-fired plants with respect to the coal resource. The Group is also concerned with land ownership, leasing and mining laws, the chemical composition of coal and any relationships between that composition and stratigraphy or lithology, mining methods, certain phases of land rehabilitation, and transportation.

Because of its central role, the Work Group must coordinate most activities with, and receive input from most of the other Work Groups, including Mineral Resources (A), Surface Resources (E) and National Energy Considerations (G). In the early stages of the Program, we also considered that the Mineral Resources Work Group would more carefully examine the technical methods of producing energy from coal as well as from other sources of energy found within the geographical region of the Northern Great Plains. Such efforts are to include review of coal gasification, in-situ processes and conventional power plants. Questions relating to hydroelectric energy conversion will be coordinated with the Water Work Group.

It is necessary for those operating in this Work Group to avoid assuming a purely mineral resources evaluation role considered typical of most earth scientists and resource-development agencies. Active involvement by EPA is directed toward assuring a more modern and responsible role that includes land use evaluations and assessments of environmental consequences of resource development. The EPA participation is also directed toward insuring public participation in all phases of the Program.

Accomplishments

The Mineral Resources (MR) Work Group has scoped its efforts to include uranium, bentonite, and relatively minor minerals (in amount), in addition to coal. Much of the effort has been directed toward producing maps and tables portraying existing and potential coal mines and the coal-related developments, power plants and gasification plants. In response to the three levels of coal production projected by the National Energy Considerations (NEC) Work Group for the Northern Great Plains, the Mineral Resources Work Group has developed three maps showing possible new mine locations, possible coal fired power plant locations, and possible coal gasification plant locations. The number of power plants and gasification plants was essentially projected by the NEC Work Group, while the hypothetical siting was projected by the MR Work Group (based on strippable coal deposits and unit-sized plants). The group has also compiled and presented existing data showing major areas of strippable coal resources in the Northern Great Plains.

The Work Group has also expended considerable effort in investigation and review of legal constraints to mining development (including such items as rail transportation costs), in documenting mineral and surface ownership, and in discussing possible mining methods for coal development. EPA has assisted the Bureau of Mines in addressing surface and underground coal mining methods. Importantly, the Work Group has strongly supported the need to test advanced methods of underground mining the western coals in an environmentally sound manner.

Activities in this Work Group have required the assistance of qualified personnel from NERC-Cincinnati and ORD in Washington, D.C. In particular, they have assisted with expertise in mining methods, land reclamation, and overall maintenance of environmental quality in the mining sector of development.

Future Activities

There are numerous areas related to the objectives of the Program and in need of further investigation that are within the scope of the Mineral Resources Work Group's efforts. Three important ones are trace element composition of coal, pre-measurement for and planning of the rehabilitation of disturbed areas, and improved mining methods. There are also areas relating to the efficiencies and economics of transporting coal as well as energy conversion methodologies.

EPA's involvement in activities related to the Mineral Resources Work Group's scope of work are estimated to be 1.0 work years through FY 75 and .75 work years through FY 76. Contract funds required for FY 75 are estimated to be $105,000 in FY 75 and $60,000 in FY 76. These funds and much of the effort are scheduled for the trace element and rehabilitation efforts.

Table B: Northern Great Plains Resources Program -- EPA Region VIII Accomplishment Plan

Mineral Resources; Subject Area "B"

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
1. Review of Work Group Work Plans; Review of work products received from Group; general management; meetings; coordination of Work Group activities with EPA regional coordinators; development of arrays describing impacts of various degrees of development; insuring public participation; participation in Siting Conference. Requires earth sciences/mining expertise combined with strong managerial capability.	0.04	0.20	0.05	0.05
2. Review of probable environmental impact of extraction of and use of energy resources contained in NGPRP region including evaluation of mining/extraction methods. Coal gasification, coal liquefication, shale oil retorting, and other existing techniques of fuel to energy conversion must be reviewed. Requires mining & earth sciences expertise.		0.10 (0.05 NERC-Cincinnati)	0.10 (0.10 NERC-Cincinnati)	0.10 (0.10 NERC-Cincinnati)

Table B (Continued)

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
3. Preparation of detailed trace-element data for western coals and in flyash to be combined with identical data for water and air. All to be combined to provide mass balances for selected trace elements (e.g. S, F, As, Ar, Cu, Sb, Bi, Hg, Mo, Ni, Pb, Be, V, Se, Ru, Cd, Sn, La, Rh, Os, Ga, Ge) (Cooperative effort with Work Groups C and D) Supplement other contracts with an appropriate research entity to perform much of this survey. Data will be solicited from DOI. Interagency agreements may be in order. EPA will provide analytical assistance for unique elemental analyses and will provide coordination of the trace element investigation. Develop and publish sampling and selected analytical techniques. Geochemical or chemical expertise desired.	0.04 (0.04 NERC-RTP)	0.10 (0.04 NERC-RTP) 15,000	0.10 (0.04 NERC-RTP) $75,000 Contract for analytical support plus cooperative neutron Activation analysis with USGS or others	0.05 $40,000

Table B (Continued)

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
4. Preparation and demonstration of mined-land reclamation methods in cooperation with Work Group E. It is proposed that this Work Group (B) provide information regarding the mechanics of achieving suitable soil surfaces to meet the land reclamation requirements specified by Work Group E (Surface Resources) and summarize the state-of-the-art. Requires combination of mining methods and landscape expertise.		0.20 (0.50 NERC-Cincinnati)	0.20 (1.00 NERC-Cincinnati) $30,000 add on contract to ongoing programs in support of regionally important R&D	0.20 (1.00 NERC-Cincinnati) $20,000
5. Review and evaluation of and strengthening of legal restraints (leases, permits, rules, regulations, law, guidelines) existing or desired to control minerals extraction -- mining law expertise required.	0.02	0.02	0.02	0.03

Table B (Continued)

Activity	Actual Activities FY 1973	Actual Activities FY 1974	Proposed Activities FY 1975	Proposed Activities FY 1976
6. Evaluation of impact of energy fuels development on other mineral resources including those occuring as trace elements and interrelationships between energy fuels such as uraniferous lignite. Earth sciences and mineral economics expertise desired.		0.07	0.05	0.02
7. Assistance with the identification and quantification of public attitudes relating to the "development" of mineral resources in and about the NGPRP area.		0.03	0.03	
8. Evaluation of Environmental impacts of advanced longwall mining in cooperation with U.S.D.I.-Bureau of Mines.			0.10 (0 30 NERC-Cincinnati) ($100,000 NERC-Cincinnati)	0.10 (0.30 NERC-Cincinnati) ($100,000 NERC-Cincinnati)
9. Investigation of feasibility and impacts of in-situ conversion of coal to gas and liquids.			0.05	0.05
10. Input to assessments and quantifications of the total efficiency with which energy fuels are converted and used.			0.10	0.05

Table B (Continued)

Activity	Actual Activities FY 1973	 FY 1974	Proposed Activities FY 1975	 FY 1976
11. Secretarial support and technical support (Drafting, etc.)	0.04	0.40	0.20	0.10
TOTALS: Regional (NERC) Work Years	0.14 (0.04)	1.12 (0.59)	1.00 (1.44)	0.75 (1.40)
Regional (NERC) Contract Funds		$15,000	$105,000 ($100,000 NERC-Cincinnati)	$60,000 ($100,000 NERC-Cincinnati)

Water Work Group

(Work Group C)

Scope of Activities

Work Group C has responsibilities for evaluating all aspects of the impact of resource development on surface and ground water quantity and quality. EPA has the lead for the water quality aspects.

Studies of water quality and pollution control involve collection and interpretation of data, determination of significant pollutants and their effect on water uses, identification and evaluation of problem areas, and formulation of alternative means for solving the problems. The analyses include the sources, amount and nature of wastes, present and expected control technology, water needs and future waste discharges for receiving bodies. Future water quality is being projected any compared with similarly-projected use requirements to identify and problem areas. Consideration will be given to alternative means of meeting quality requirements in problem areas.

As part of the water resource work group, EPA participates in the evaluation of environmental impacts resulting from water resource facility construction, i.e., dams, reservoirs, pipelines, canals. EPA is also evaluating water quality impacts from increased population, urbanization, and associated industrialization or changes in water use that may occur within the study area.

The effects of pollution on various water uses and on plans for improving water quality in affected areas are being determined. Water quality goals (ambient standards and other criteria) are being established and means to meet the demands are being closely coordinated with other facets of the study. This involves analyses of flows, treatment, and other control measures which will be needed to meet requirements for municipal, industrial, agricultural, recreational, and other water uses. Data from other agencies has been reviewed and utilized where appropriate to provide information on amount and nature of pollutants from natural sources and to determine stream and ground water characteristics and other major considerations reflecting the physical effects of receiving bodies on water quality.

The difficulty of maintaining or restoring water quality could be increased because of the large depletions which could be made on the river system of the Northern Great Plains. The flow-water quality requirements of present and potential future instream water needs are being determined. These flow-water quality requirements will indicate the minimum quantity of water needed to carry natural pollution loads that are difficult to control and to maintain a physically and biologically viable stream system. With this information, water resources management plans could assure that minimum stream flows would be maintained to meet instream needs for quality control.

Although many pollution control situations will be met with existing information, there is a continuing need for technological improvements in waste treatment, alternative water uses, and land treatment and erosion control measures. The Water Work Group is serving to focus adequate study and evaluation on alternate means of cooling, including air cooling. Methods and practices for the control of adverse water quality impacts from strip mining-disturbed lands are not fully known. The impact of coal mining on the supply and quality of ground water is not known. Effective land reclamation measures will be demonstrated.

As lead agency for the water quality subgroup, EPA has the primary responsibility for collecting, compiling, analyzing, and writing report material. Coordination and cooperation procedures with other Federal agencies, State agencies, and universities, local interests and industrial and environmental groups will be maintained for the interchange of information, development of inputs to the study and review and assistance in the plan's formulation process. Contracts are being utilized to provide information and assistance in those activities where it is deemed appropriate.

Accomplishments

The Water Work Group has been organized under the direction of Mr. Phil Gibbs of the U.S. Bureau of Reclamation. To facilitate the water study, the work group was divided into several sub-groups. Subgroups were formed for Instream Values, Wild-Scenic Rivers, Recreation, Ground Water, Flood Control, Operational Studies, and Water Quality. EPA is the leader of the Water Quality Subgroup and has members on the Ground Water and Instream Values Subgroups.

The Instream Values Subgroup has developed hypothetical minimum flows for the reaches of each stream likely to be impacted. Development of coal that would result in diversions of water that would in turn deplete streams below that flow were not to be allowed. The flows served as input into the Operational Studies Subgroup which developed information on water availability in each basin.

EPA, as leader of the Water Quality Subgroup, attended all meetings of the Water Work Group and the Instream Values and Ground Water Subgroups. EPA established a water quality work plan, established operating procedures and policies for the subgroup, then staffed itself for implementation of the work plan. The following discussion represents the major accomplishments of EPA as a member of the Water Work Group.

A Regional profile report, summarizing quantity and quality of water in the Region, has been written and is available through the Water Quality Subgroup interim report. Included by EPA in the report are: (1) summaries of existing water quality data showing present general quality, problem areas and major trends for the major streams in the

NGP; and (2) general information on the quality of existing fisheries in the major streams and other biological information where available.

Existing data on water quality were determined to be inadequate. Therefore, EPA has entered into interagency agreements with the various Water Resource District offices of the USGS to supplement certain existing water quality data collection stations and to establish others at key locations. Figures 16-19 show these stations along with the existing network.

Finding that data concerning the fate of those elements during combustion of coal at power plants were extremely scarce, EPA has also entered into an agreement with the USGS in North Dakota and Wyoming to analyze waters around representative power plants for over thirty trace elements (Table 8). This effort will be of a reconnaissance nature.

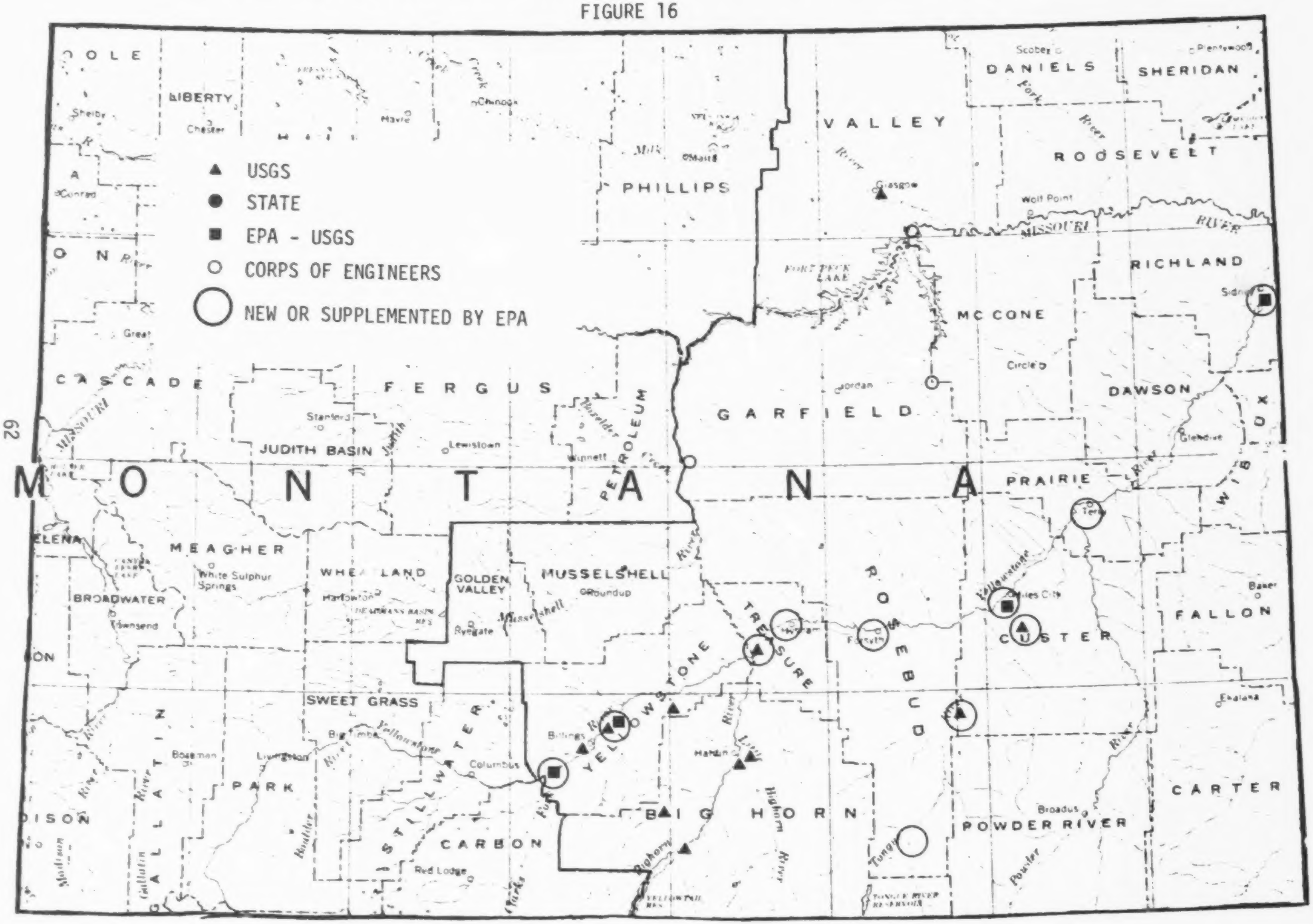
Major sources of pollution needed to be identified before analysis of future water quality could begin. Special "white papers" have been prepared for certain types of expected effluents which address water quality problems of each industry and possible treatment alternatives. Such special documents have been prepared for power plants, surface mines, feedlots, irrigation, and municipalities. These are published in the Water Quality interim report. Going one step farther for coal conversion facilities, work has been initiated that would study water requirements and water use alternatives in much greater detail. A report which (1) discusses the state-of-the-art on blowdown minimization for wet cooling towers; (2) performs cost optimization for power plant cooling systems; (3) gives preliminary data on water use in coal gasification; and (4) summarizes information needs relative to water use alternative assessment has been prepared by NERC-Corvallis and is available in the interim report of the Water Quality Subgroup. An outline of the Water Quality Subgroup interim report is given in Table 9.

Broad assumptions concerning future effluents, probable depletions, secondary growth impacts and other water quality factors have been developed in preliminary form. These and other data have been created for use in simplistic models to project surface water quality changes in the parameters dissolved oxygen and total dissolved solids for various regional rates of coal mining and related development. A contract has been completed which reports on available methods for predicting sediment yields in the NGP. Computer programs for storm simulation, hydrology modeling, sediment yield predictions, and stream transport and deposition modeling are abstracted in this report. The report entitled "Available Computer Programs for the Prediction and Evaluation of Sediment Erosion, Transportation and Deposition", recommends a "best" set of models for use in the NGP. This report will be published in subsequent work group reports.

Although most discussions of proposed development involve either mine mouth conversion facilities or export mines to serve conversion

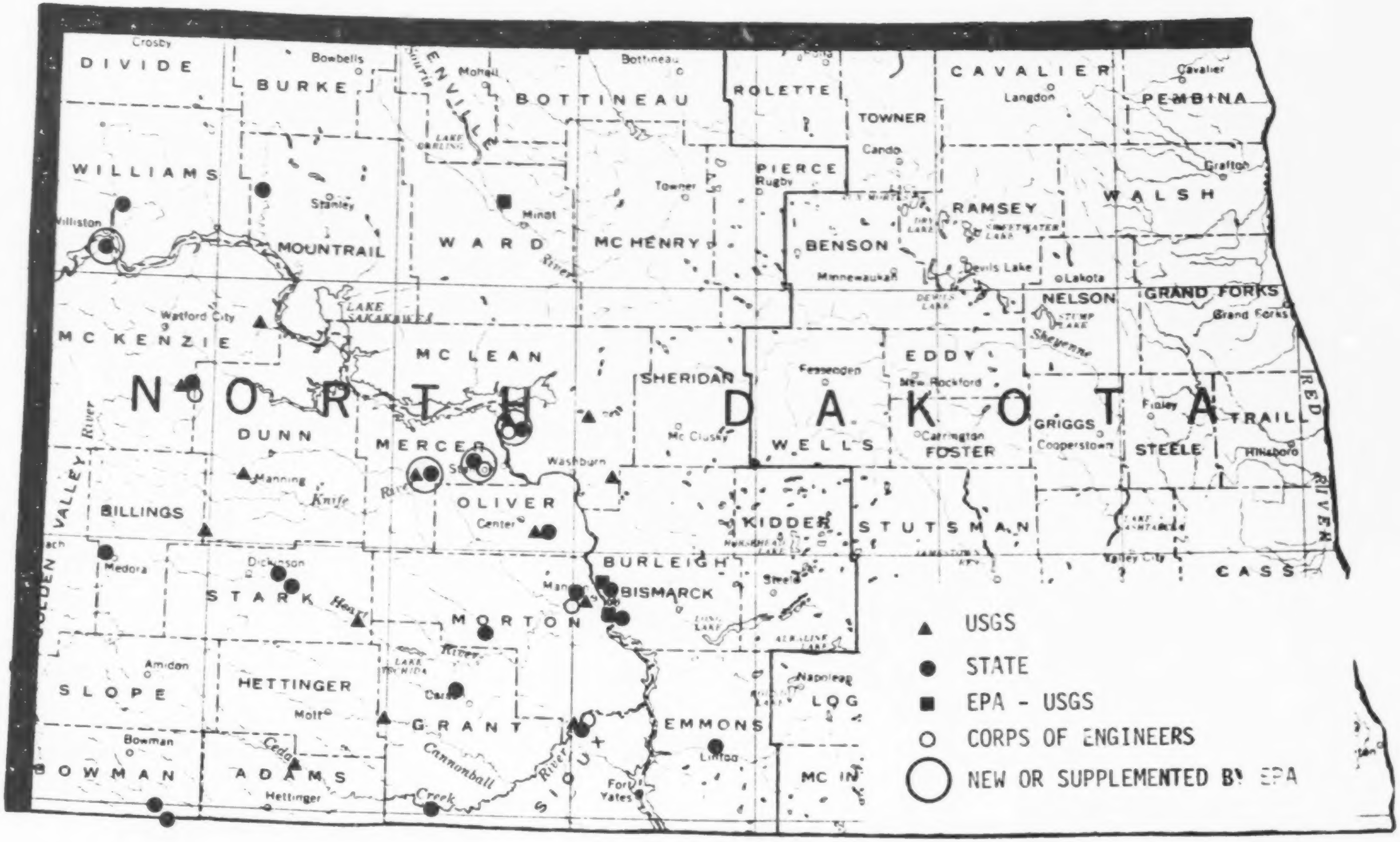
Water Quality Stations in the Northern Great Plains Region of Montana

FIGURE 16


▲ USGS
● STATE
■ EPA - USGS
○ CORPS OF ENGINEERS
◯ NEW OR SUPPLEMENTED BY EPA
MONTANA
LIBERTY
PHILLIPS
VALLEY
DANIELS
SHERIDAN
ROOSEVELT
RICHLAND
MC CONE
GARFIELD
DAWSON
WIBAUX
PRAIRIE
FALLON
CUSTER
CARTER
POWDER RIVER
ROSEBUD
TREASURE
BIG HORN
YELLOWSTONE
MUSSELSHELL
PETROLEUM
FERGUS
JUDITH BASIN
CASCADE
MEAGHER
WHEATLAND
GOLDEN VALLEY
SWEET GRASS
STILLWATER
CARBON
PARK
GALLATIN
BROADWATER
Shelby
Chester
Havre
Chinook
Glasgow
Scobey
Plentywood
Wolf Point
MISSOURI RIVER
FORT PECK LAKE
Sidney
Circle
Jordan
Glendive
Terry
Miles City
Baker
Ekalaka
Broadus
Forsyth
Hysham
Billings
Hardin
Columbus
Red Lodge
Big Timber
Livingston
Bozeman
Roundup
Ryegate
Harlowton
White Sulphur Springs
Townsend
Lewistown
Stanford
Winnett
Great Falls
Conrad
Yellowstone River
Bighorn River
Tongue River
Powder River
TONGUE RIVER RESERVOIR
YELLOWTAIL RES.

Water Quality Stations in the Northern Great Plains Region of North Dakota

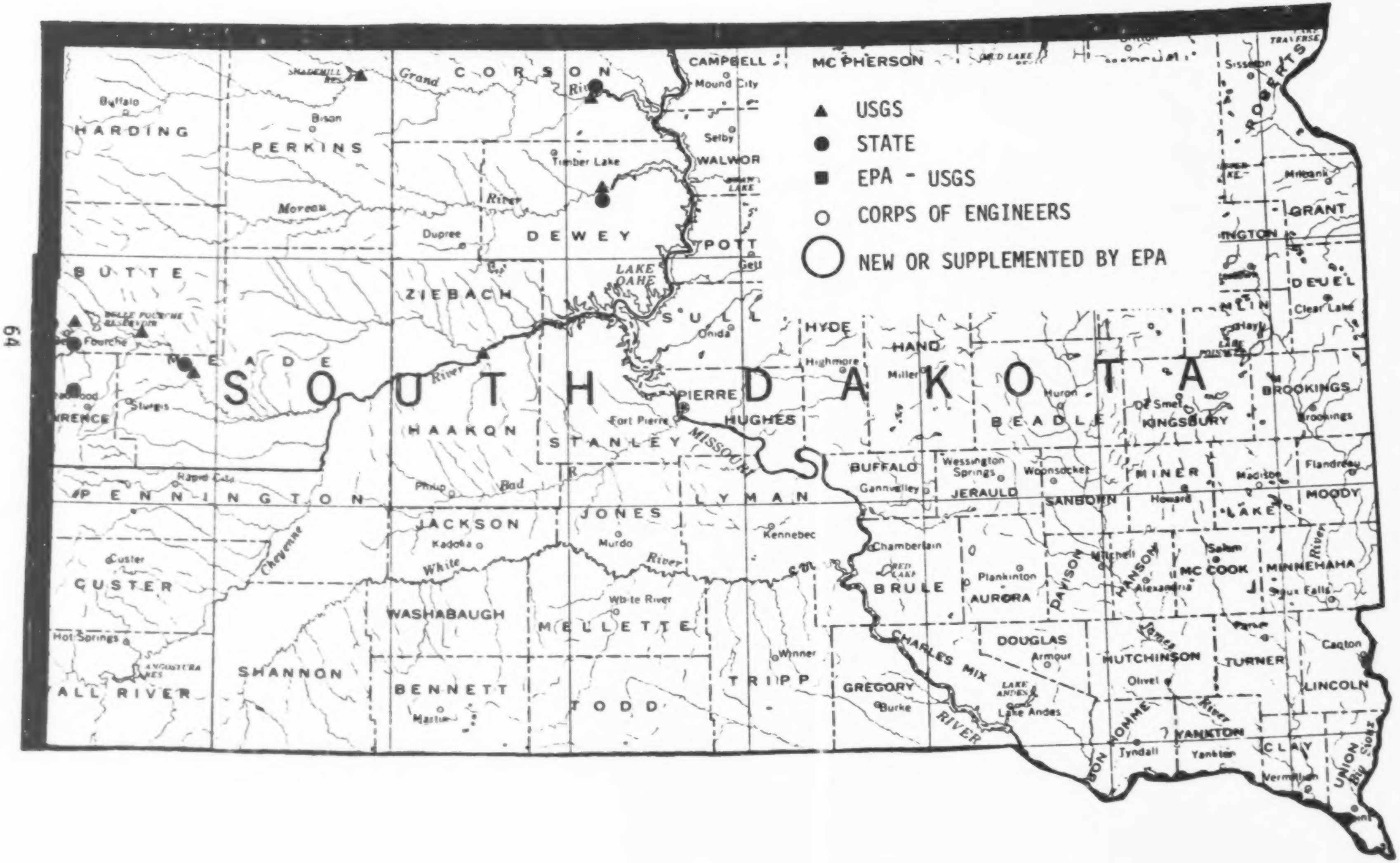
FIGURE 17



NORTH DAKOTA
DIVIDE
BURKE
RENVILLE
BOTTINEAU
ROLETTE
TOWNER
CAVALIER
PEMBINA
WILLIAMS
MOUNTRAIL
WARD
MC HENRY
PIERCE
BENSON
RAMSEY
WALSH
NELSON
GRAND FORKS
MC KENZIE
MC LEAN
SHERIDAN
WELLS
EDDY
FOSTER
GRIGGS
STEELE
TRAILL
DUNN
MERCER
OLIVER
BILLINGS
KIDDER
STUTSMAN
BURLEIGH
CASS
GOLDEN VALLEY
STARK
MORTON
SLOPE
HETTINGER
GRANT
EMMONS
LOGAN
BOWMAN
ADAMS
SIOUX
MC INTOSH
Crosby
Bowbells
Mohall
Bottineau
Langdon
Cavalier
Grafton
Cando
Rugby
Towner
Stanley
Minot
Williston
Watford City
Minnewaukan
Devils Lake
Lakota
Grand Forks
Fessenden
New Rockford
Carrington
Cooperstown
Finley
Hillsboro
Mc Clusky
Washburn
Stanton
Center
Manning
Medora
Dickinson
Mandan
Bismarck
Steele
Valley City
Amidon
Mott
Carson
Napoleon
Linton
Bowman
Hettinger
Fort Yates
Lake Sakakawea
Lake Darling
Devils Lake
Red River
Souris
Knife River
Heart River
Cannonball
Cedar Creek
Sheyenne
▲ USGS
● STATE
■ EPA - USGS
○ CORPS OF ENGINEERS
◯ NEW OR SUPPLEMENTED BY EPA

Water Quality Stations in the Northern Great Plains Region of South Dakota

FIGURE 18


▲ USGS
● STATE
■ EPA - USGS
○ CORPS OF ENGINEERS
◯ NEW OR SUPPLEMENTED BY EPA
SOUTH DAKOTA
HARDING
PERKINS
CORSON
CAMPBELL
MC PHERSON
WALWOR
DEWEY
ZIEBACH
BUTTE
MEADE
HAAKON
STANLEY
HUGHES
HYDE
HAND
BEADLE
KINGSBURY
BROOKINGS
DEUEL
GRANT
ROBERTS
PENNINGTON
JACKSON
JONES
LYMAN
BUFFALO
JERAULD
SANBORN
MINER
LAKE
MOODY
CUSTER
BRULE
AURORA
DAVISON
HANSON
MC COOK
MINNEHAHA
WASHABAUGH
MELLETTE
SHANNON
BENNETT
TODD
TRIPP
GREGORY
CHARLES MIX
DOUGLAS
HUTCHINSON
TURNER
LINCOLN
BON HOMME
YANKTON
CLAY
UNION
FALL RIVER
LAKE OAHE
MISSOURI
RIVER
Grand
Moreau
Cheyenne
White
Bad
James
Big Sioux
Buffalo
Bison
Timber Lake
Dupree
Mound City
Selby
Onida
Pierre
Fort Pierre
Highmore
Miller
Huron
De Smet
Brookings
Sisseton
Milbank
Clear Lake
Flandreau
Madison
Howard
Woonsocket
Wessington Springs
Gannvalley
Kennebec
Murdo
Kadoka
Philip
Rapid City
Sturgis
Belle Fourche
Custer
Hot Springs
White River
Martin
Winner
Burke
Chamberlain
Plankinton
Mitchell
Alexandria
Salem
Sioux Falls
Canton
Parker
Olivet
Armour
Lake Andes
Tyndall
Yankton
Vermillion

Water Quality Stations in the Northern Great Plains Region of Wyoming

FIGURE 19

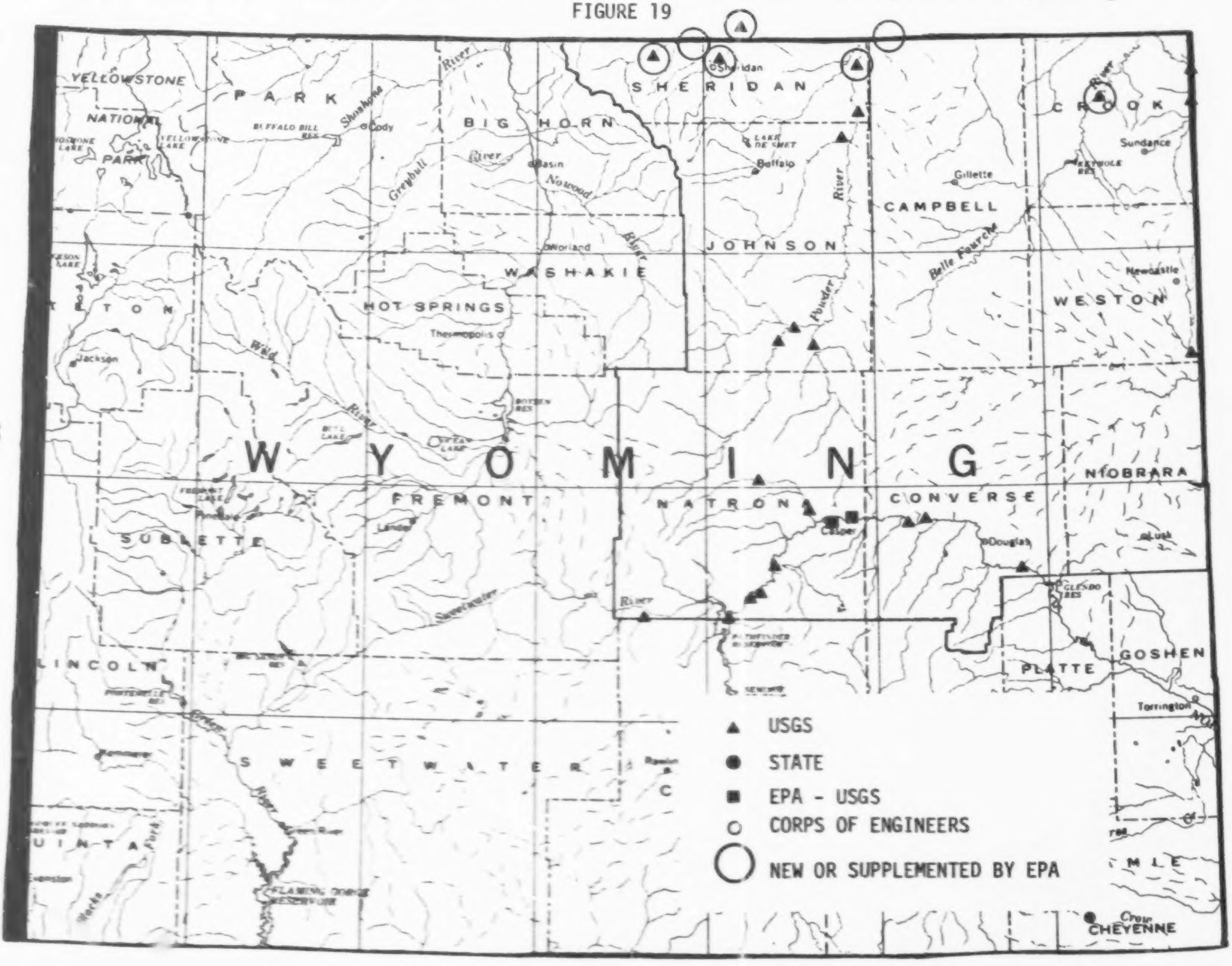

WYOMING
YELLOWSTONE NATIONAL PARK
PARK
BIG HORN
SHERIDAN
CROOK
CAMPBELL
JOHNSON
WASHAKIE
HOT SPRINGS
WESTON
NIOBRARA
FREMONT
NATRONA
CONVERSE
SUBLETTE
LINCOLN
SWEETWATER
UINTA
PLATTE
GOSHEN
Cody
Sheridan
Buffalo
Basin
Worland
Thermopolis
Gillette
Sundance
Newcastle
Jackson
Lander
Casper
Douglas
Lusk
Torrington
Cheyenne
Buffalo Bill Res
Lake De Smet
Boysen Res
Glendo Res
Flaming Gorge Reservoir
Shoshone
Greybull
River
Nowood
Wind
Powder
Belle Fourche
Sweetwater
Green
USGS
STATE
EPA - USGS
CORPS OF ENGINEERS
NEW OR SUPPLEMENTED BY EPA

TABLE 8

Trace Elements Investigated in the Vicinity of Power Plants

Aluminum
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Cerium
Chromium
Cobalt
Copper
Fluoride
Gallium
Iron
Lead
Lithium
Manganese
Mercury
Molybdenum
Nickel
Radium
Selenium
Strontium
Tin
Titanium
Uranium
Vanadium
Ytterbium
Zinc
Zirconium

TABLE 9

OUTLINE OF THE WATER QUALITY SUBGROUP INTERIM REPORT

I Water Quality Regional Profile
  A. Water Quality Measurement in the NGP
  B. Present Stream Quality by Basin
  C. Important Water Quality Influences

II Water Use Alternatives
  A. Water Requirements for Power Plants with Wet Cooling Towers
  B. Engineering and Economic Aspects of Wet and Dry Cooling Systems
  C. Water Usage in the Conversion of Coal to Pipeline Quality Gas

III Stream Flows Used for Water Quality Analysis

IV Water Quality Impacts of Coal Development
  A. Projections of Total Dissolved Solids Concentrations for NGP Coal Development
  B. Analysis of Dissolved Oxygen Impact of Selected Locations within NGP
  C. Qualitative Discussion/Water Quality Impacts
  D. Potential Effects of Proposed Impoundments on Water Quality and Fisheries in the NGP
  E. Impacts for Alternative Sites for Coal Conversion Facilities

V Quality of Ground Water

VI Areas Where Additional Data/Analytical Tools are Necessary
  A. Surface Water Quality and Hydrologic Network
  B. Non-Point Source Pollution in NGP
  C. Identification and Quantification of Source Terms for Water Quality Predictions Related to Coal Development
  D. Water Use Requirements and Alternatives for Coal Development
  E. Development of Modelling Tools for Surface Water Quality Projections
  F. Development of Verified Instream Needs for All Streams
  G. Assessment of Shallow and Deep Ground Water Resources and the Impact of Coal "Development" on these Resources
  H. Alternative Siting of Coal Conversion Facilities Near Large Water Bodies
  I. Leading Potential of Spoil and Spoils Material Near Coal
  J. Analysis of Impacts of Trans-Basin Diversions
  K. Identification of Correlations between Trace Element Content of Surface and Near Surface Waters, Parent Material Soils and Sediment
  L. Effects of Impoundments on Free Flowing Streams in NGP

VII Appendices
  A. Water Quality Criteria for TDS
  B. Supplementary Material for Section I-C

TABLE 9 (Continued)

C. The Determination, Assessment, and Design of "Instream Value" Studies in the NGP Region
D. Questions Concerning Indian Water Rights
E. A Discussion of Reservoir Limnology with Special Reference to Proposed Reservoirs in the NGP

facilities at load centers or synthetic natural gas plants, a third type of development seems likely. Given the general arid climate and water shortage of the area, environmental and economic problems associated with massive water diversions may dictate that conversion facilities locate nearer water. Therefore, an agreement has been reached between EPA and a group of electric generating companies to evaluate physical impacts of once-through cooling facilities for power plants located on the Missouri River. The necessity to cover all alternatives requires the investigation of moving coal to water as well as water to coal.

Where development does occur at the coal mine and water is conveyed to such development, the possibility of reducing in-stream flows to critical levels is possible. However, data on minimum flows to maintain and improve aquatic ecosystems are lacking. Therefore, EPA has entered into a contract with the University of Montana to define and evaluate in-stream needs assessment methodologies with regard to their appropriateness in the Northern Great Plains and to develop a methodology that can be used to predict the effects of lowered regulated stream flow on the aquatic ecosystem. This effort will conclude in 1974 and will be followed by a two-year field effort which will involve collecting biological data to evaluate and assess the chosen methodology(ies). A preliminary report from the first stage of this effort has been prepared and is included in the interim Water Quality Subgroup report.

A second issue relative to depletions is water rights. The water group as a whole has addressed the question in its report on Constraints to Water Resource Development. That report discusses all constraints to water use in the NGP such as legal, institutional, economic, environmental, aesthetic, and technical. Copies will be in the NGPRP report repositories. In addition, EPA has written a critique of the Winters Doctrine which shows how the question of Indian water rights is critical to coal development in the area. This document is in the interim Water Quality Subgroup report.

To provide water for continued depletions, additional storage capacity will eventually be required. On most streams, reservoirs can be expected if significant water is to be diverted from that stream. Therefore, EPA has investigated the effects on water quality of impoundments on free flowing streams. A paper has been written on the expected impacts of such a reservoir emphasizing reservoir limnology. While preliminary estimates of water availability indicate no new reservoirs may be needed for some time, actual developments seem to point toward some new reservoirs in the near future. Work is continuing in this effort.

Surface water is not the only water potentially affected by coal development. EPA has participated in the formation of an active Ground Water Subgroup and has contributed substantial funding to the effort. The Montana Division USGS is heading this investigation, which is designed to assess the potential physical and chemical impacts of strip mining on ground water at the Colstrip and Decker-Birney areas in Montana; at the Gillette area of Wyoming; and at the Gascoyne area of North Dakota. The group, with EPA participation, has summarized existing ground water investigations and has provided a preliminary discussion of important issues relating to ground water. A ground water monitoring network is being established to provide needed data in the aforementioned geographical areas.

EPA has, through the Water Quality Subgroup, participated with other work groups on joint projects. As mentioned above, the fate of the trace elements in coal during combustion is not known. Therefore, EPA has initiated an effort to conduct chemical mass balance of selected trace elements around existing power plants. The work is a joint effort of the Atmospheric Aspects Work Group and the Water Quality Subgroup.

Future Activities

Although much has been done, much remains still to be done. Table C shows the areas where significant efforts must be expanded in FY 75. Emphasis must be placed on continued data collection in areas which have not been adequately addressed to date. Data needs include, but are not limited to, areas concerning: non-point source pollution; aquatic ecosystem habitats and needs; trace element concentrations, and ecological effects, and a better description of the hydrologic regime, water use and quality of rivers in the region. A more complete data base will enable use and development of more reliable tools for evaluating impacts on water quality. Analytical tools are being used, developed and evaluated in efforts 4, 5, 6, 7, 8 and 9 listed in the following chart. There will be continued emphasis of potential water quality impacts during the remainder of FY 1974 for the interim report of the NGPRP. EPA can be expected to continue to lead the efforts aimed at evaluating water quality effects, and can also be expected to exert more influence in the overall management of the Water Work Group in FY 75.

EPA involvement in FY 75 will remain broad. Agency experts in the National Thermal Pollution Research Program in Corvallis, and the National Ecological Research Laboratory in Corvallis will continue to be utilized. Academic personnel from the University of Montana and other qualified universities will continue to participate. In addition, state government representatives, representatives of the environmental community, and representatives of industry are expected to be active participants and to greatly add to the program. Such close cooperation and coordination of diversified interests and talents is one objective of the NGPRP.

In addition, methods of insuring adequate planning and management of future water quality, in areas likely to receive coal development will be explored. Section 208 of Public Law 92-500 allows the Governor of any state to designate areas which have (or may have) substantial water quality control problems. This designation includes boundaries and a single representative organization capable of developing effective area-wide waste treatment management plans for the area.

Complete Federal funding is available through FY 75 for the costs of developing and operating a continuous area-wide waste treatment management process. The plan can include identification of needed treatment works, a process to identify mine related sources of pollution, agricultural and silvicultural related pollution sources, and construction activity related sources, and to set forth procedures and methods to control such sources as well as other needed items. In short a funded institutional mechanism for taking the data and analytical methodologies developed by the water work group can be established and that institution can then plan and manage all point and nonpoint water pollution sources to insure adequate water quality is maintained. Efforts to establish such a planning and management tool will be initiated.

The allocation of resources for this area is 3.6 work years for FY 75 (plus 2.5 work years for NERL-Corvallis), and 1.5 work years for FY 76 (plus 2.5 work years for NERL-Corvallis). Contract support of $240,000 (plus $350,000 for NERL-Corvallis) in FY 75 and $180,000 (plus $350,000 for NERL-Corvallis) in FY 76 is also required.

Table C: Northern Great Plains Resources Program -- EPA Region VIII Accomplishment Plan

Water: Subject Area "C"

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
1. **Water Quality Subgroup Leader**	0.30	0.30	0.50	0.20
a. Participate as team member in studying the water-related effects of energy resource development, including planning and coordinating total effort.				
b. Act as leader in team effort to assess water quality impacts of energy resource material, including planning, coordinating, and implementing study efforts.				
c. Attend meetings of the Program, of water group, of water quality subgroup, etc., prepare reports, give briefings.				

Table C (Continued)

	Actual Activities		Proposed Activities	
Activity	FY 1973	FY 1974	FY 1975	FY 1976
2. Water Quality Data		0.50	0.35	0.10
a. Improve, supplement, and expand existing ambient water quality data in NGP area. b. Establish improved inventory of existing discharges, locations, waste loads, and permit conditions. c. Compile inventory of major non-point source water pollution problems in NGP		$57,150	$60,000 for interagency agreement with USGS needed to keep water quality network active	$60,000 for interagency agreement with USGS needed to keep water quality network active
3. Determine water use requirements and alternatives in coal conversion (conventional steam electric generating plants and coal gasification plants) including:		0.50 (0.30 NERC-Corvallis) $8,000	0.10 (2.50 NERC-Corvallis) ($326,000-NERC-Corvallis)	0.05 (2.50 NERC-Corvallis) ($95,000 NERC-Corvallis)
a. Identification and quantification of all water uses in coal conversion. b. Identification of the costs of alternative technologies that minimize water use requirements.			Entire project to be coordinated by NERC-Corvallis	Entire project to be coordinated by NERC-Corvallis

Table C (Continued)

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
c. Identification of the availability, maintainability, and reliability of alternate water use technologies.				
d. Development of comparison or evaluation methodologies which result in optimum water use schemes in coal conversion by cost by water conservation, by reliability, etc.				
e. Define effluent requirements (BPT, BAT, NSPS) for coal conversion facilities (Region VIII).				
4. Project Surface Water Quality		0.25	0.75	0.25
a. Evaluate, choose and modify appropriate model for analysis, including data required and its availability.		$2,500	$25,000 for consultant and field work	$15,000 for consultant and field work
1. Design, implement data collection network				
2. Perform stream surveys for quantitative, qualitative indication of quality for modeling data.				

Table C (Continued)

Activity	Actual Activities FY 1973	 FY 1974	Proposed Activities FY 1975	 FY 1976
b. Project surface water quality via application of models. Include sediment yield modeling.				
c. Develop modeling manual summarizing modeling techniques, input requirements, assumptions, sensitivity, and general usefulness as predictive total.				
5. Instream Needs Requirement		0.50	0.20	0.10
a. Complete methodology development that will show how to assess instream needs for the maintenance and improvement of aquatic ecosystems.		$45,641	$20,000 for continuation of field verification	
b. Field evaluation, assessment, testing, and preliminary implementation of instream needs methodology. A two-year field verification is required.				

Table C (Continued)

Activity	Actual Activities FY 1973	Actual Activities FY 1974	Proposed Activities FY 1975	Proposed Activities FY 1976
6. Ground Water Impact Evaluation		0.25	0.20	0.15
a. Continued monitoring of quantity and quality impacts on ground water of coal development at selected sites in three states.		$25,415	$70,000 for interagency agreement with USGS for site specific studies	
b. Investigate physical and chemical effects on ground water at additional, likely to be developed, sites.				
1. Area of glacial significance in North Dakota				
2. Lignite fields in Montana (gasification potential)				
c. Investigate quality, effects of development, of intermediate aquifers.				
d. Investigate quality, availability, costs, effects of utilizing deep (Madison) aquifer ground water				

Table C (Continued)

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
7. Chemical Mass Balance		0.25	0.10	0.05
a. Continue working with air work group for detailed mass balance development at selected power plants of significant trace elements. Power plants chosen to be representative of typical coal and air pollution coated devices.		$11,300	Continued work on existing contract	
b. Initiate new chemical mass balance in conjunction with field ecological survey.				
8. Field Evaluation of Effects of Once Through Cooling		0.05	0.20	0.10
a. Develop a detailed study of physical and biological effects associated with once through cooling, including water conservation. This study should be a model of a study sufficient to show feasibility, (or lack of feasibility) under Section 316(a) PL 92-500.			$5,000 to set up study	
b. Begin a coordinated implementation of the study in conjunction with interested utilities.			$50,000 to implement study via contract	$70,000 for continued implementation of study

Table C (Continued)

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
9. Evaluation of Water Related Impacts		0.05	0.05	0.02
a. Review EIS's of proposal development				
b. Study effects associated with water resource development, such as dams, canals, pipelines, etc.				
c. Analyze impacts of transbasin diversions.				
d. Evaluate secondary growth impacts on water quality.				
10. Biological Data Requirements		0.20	0.15	0.08
a. Assist states in collecting, analyzing biological data needed to evaluate impact from proposed development.			$40,000 for contract assistance to states	$40,000 for contract assistance to states
b. Collect specific biological information necessary to support other work group activities.				
11. Secretarial support		1.00	1.00	0.40
TOTALS: Regional (NERC) Work Years	0.30	3.85 (0.30)	3.60 (2.50)	1.50(2.50)
Regional (NERC) Contract Funds		$134,241	$240,000 ($326,000)	$180,000 ($95,000)

Atmospheric Aspects Work Group

(Work Group D)

Scope of Activities

This work group coordinates the various research efforts proposed or underway in the study area which relate to the atmospheric impact of resource development. Areas of work include coal conversion technology, emissions control technology, ambient air quality monitoring, meteorological data acquisition, air quality diffusion modeling, visibility determination methodology and trace element studies. Data in these areas are needed in order to evaluate alternative strategies for resource development. The data accumulated to date plus the proposed on-going activities regarding data acquisition will be discussed in the June 1974 interim report. A final report will be issued in October of 1975. Contact has been made with governmental agencies, universities, environmental groups, and pertinent industries to inform them of the objectives of the NGPRP, more specifically the Atmospheric Aspects Work Group, and to request their cooperation and participation. Atmospheric Aspects Work Group meetings which are held periodically serve to provide a source of information as well as feedback to strategies for the assessment of the atmospheric impact of proposed resource development.

Accomplishments

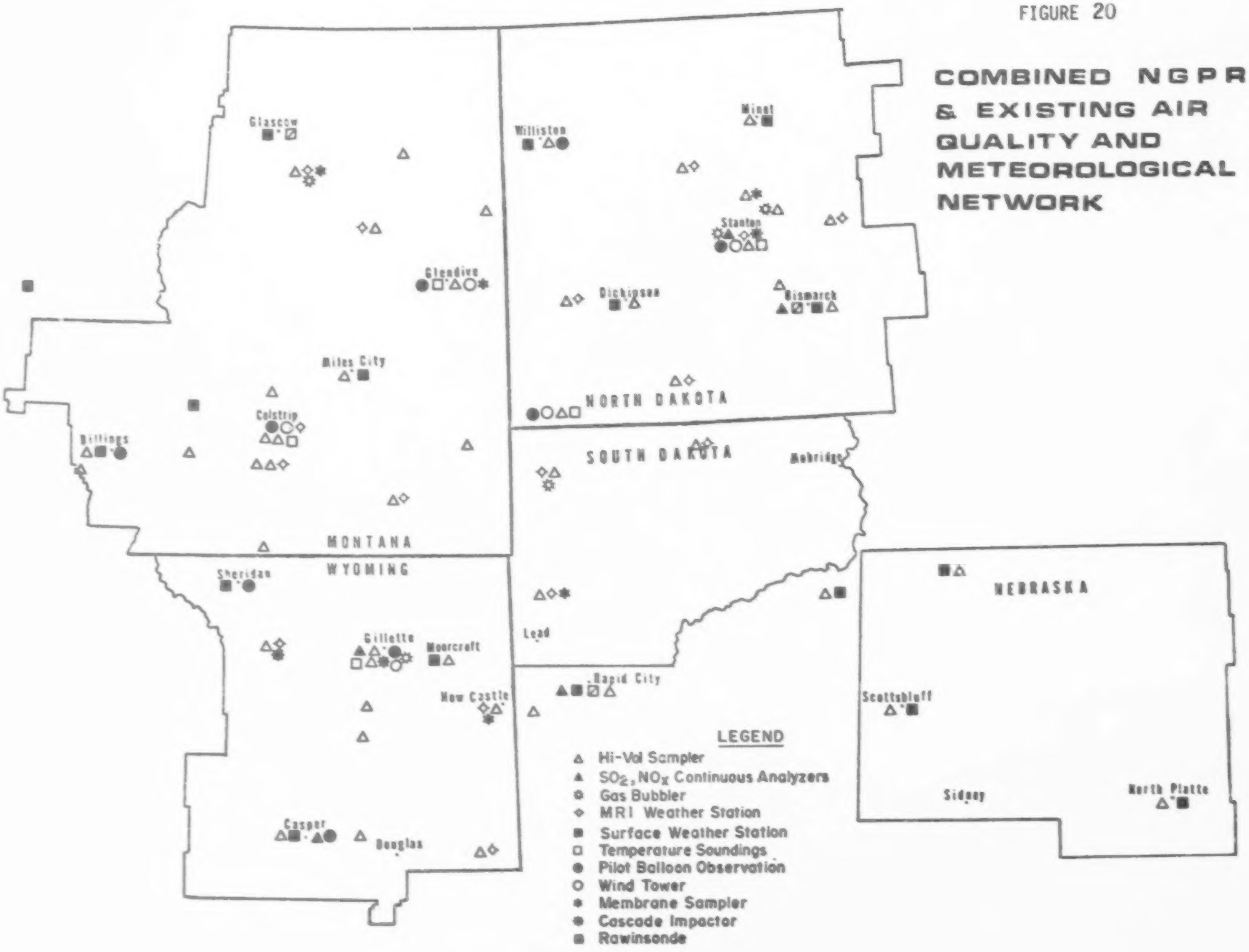
1. Establishment of NGPRP Air Quality and Meteorology Monitoring Network

The Atmospheric Aspects Work Group has created a comprehensive network designed to acquire air quality and meteorological data that is presently unavailable. It is expected that the complete sampling network will be operational by July 1974. Sampling sites are illustrated in Figure 20. Existing (pre-NGPRP) sampling stations appear in Figure 21. Table 10 lists the instrumentation which is or will be located at each of the air quality monitoring stations. The high-volume membrane, cascade impactor, and gas bubblers samplers will collect a sample every six days. The hi-vol sample will be analyzed for total particulate matter, trace elements, sulfates, nitrates, and fluorides. The membrane and cascade impactor samples will be analyzed for trace elements. The gas bubblers will measure SO_2 and NO_x concentrations in the atmosphere. Meteorological data in the form of temperature soundings and upper atmosphere wind speed and direction will be measured twice daily every other day. Surface wind speed and direction will be recorded continuously at 16 locations where hi-vols are operating. SO_2 and NO_x levels will be continuously monitored at two locations.

These data should serve to provide an excellent data base, when combined with all state and industry collected data, to determine the existing or background air quality levels.

FIGURE 20

COMBINED NGPRP & EXISTING AIR QUALITY AND METEOROLOGICAL NETWORK



Glascow
Williston
Minot
Stanton
Dickinson
Bismarck
Glendive
Miles City
Colstrip
Billings
NORTH DAKOTA
SOUTH DAKOTA
Mobridge
MONTANA
WYOMING
Sheridan
Gillette
Moorcroft
New Castle
Lead
Rapid City
Casper
Douglas
NEBRASKA
Scottsbluff
Sidney
North Platte
LEGEND
△ Hi-Vol Sampler
▲ SO_2, NO_x Continuous Analyzers
✲ Gas Bubbler
◇ MRI Weather Station
■ Surface Weather Station
□ Temperature Soundings
● Pilot Balloon Observation
○ Wind Tower
✱ Membrane Sampler
✹ Cascade Impactor
▨ Rawinsonde

FIGURE 21

EXISTING AIR QUALITY AND METEOROLOGICAL NETWORK

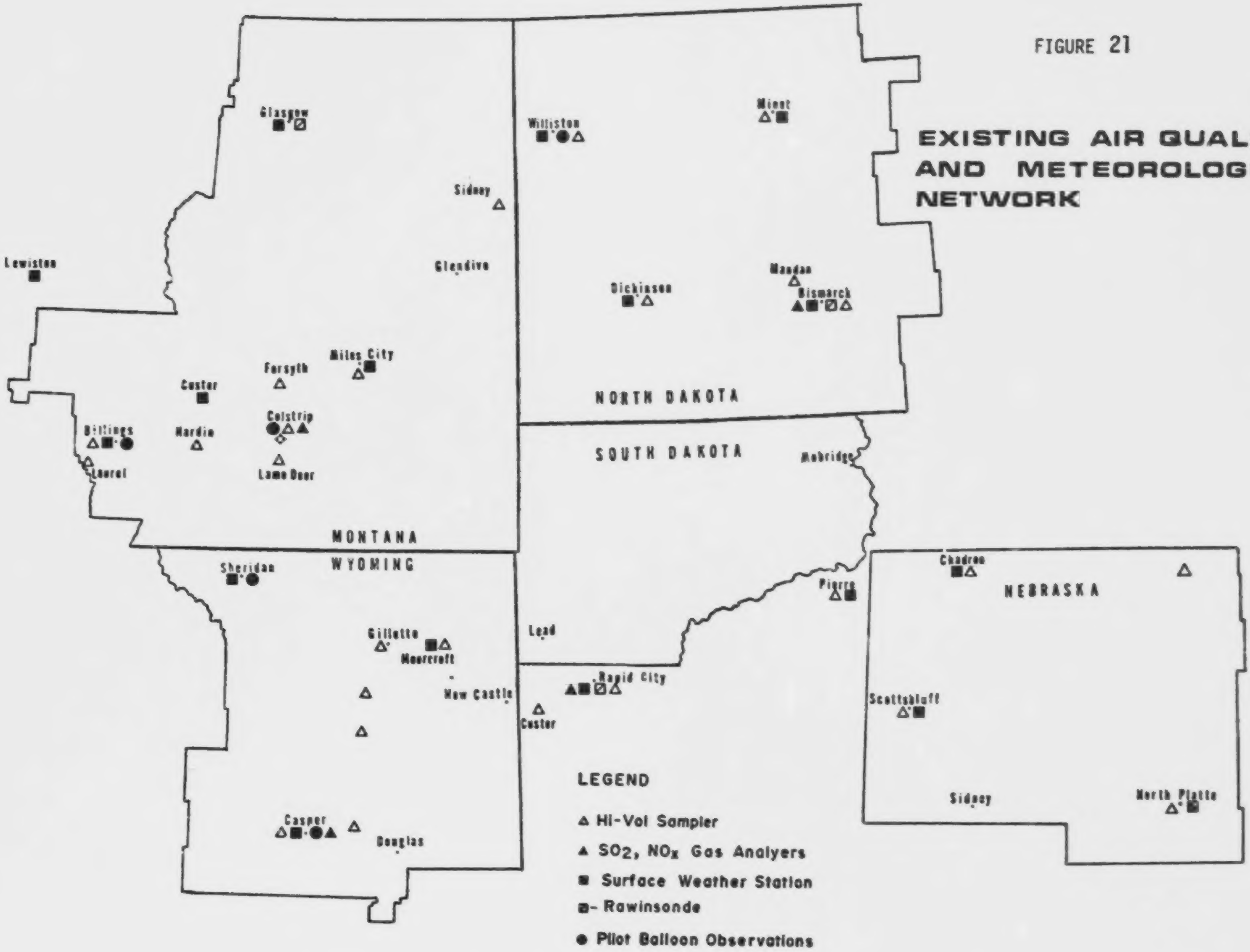

Lewiston
Glasgow
Sidney
Glendive
Miles City
Forsyth
Custer
Billings
Laurel
Hardin
Colstrip
Lame Deer
MONTANA
WYOMING
Sheridan
Gillette
Moorcroft
New Castle
Casper
Douglas
Williston
Minot
Dickinson
Mandan
Bismarck
NORTH DAKOTA
SOUTH DAKOTA
Mobridge
Pierre
Lead
Rapid City
Custer
Chadron
NEBRASKA
Scottsbluff
Sidney
North Platte
LEGEND
△ Hi-Vol Sampler
▲ SO2, NOx Gas Analyers
■ Surface Weather Station
▨ - Rawinsonde
● Pilot Balloon Observations

TABLE 10

NGPRP ATMOSPHERIC ASPECTS MONITORING NETWORK

	INSTRUMENTS						
LOCATION	Hi-Vol	Membrane	MRI Station	SO_2-NO_x Continuous	SO_2-NO_2 Bubbler	Cascade Impactors	Pilot Balloon OBS; T-Sondes; Wind Towers
Buffalo, WY	X		X			X	
Gillette, WY	X			X	X	X	X
Lusk, WY	X		X				
Newcastle, WY	X	X	X				
Belle Fourche, SD	X	X	X				
Buffalo, SD	X		X		X		
Lemmon, SD	X		X				
Parshall, ND	X		X				
Garrison, ND	X	X					
Washburn, ND	X				X		
McClusky, ND	X		X				
Bowman, ND	X						X
Stanton, ND	X		X	X	X	X	X
Mott, ND	X		X				
Medora, ND	X		X				
Lame Deer, MT	X		X				
Broadus, MT	X		X				
Ekalaka, MT	X						
Glendive, MT	X	X	X				X
Lindsay, MT	X						
Poplar, MT	X		X				
Ft. Peck, MT	X	X	X		X		
Colstrip, MT							X

2. Trace Elements Mass Balance Around Coal Fired Power Generation Plants

Three sites have been selected to perform our study. The three plants burn different types of coal and have different pollution control devices. These plants were contacted during February 1974 via letter followed by a personal visit to the parent company in order to explain our research study effort. A contract will be let by June 1, 1974, to perform a detailed sampling program for the three plants. Samples of coal, bottom ash, collected fly ash and flue gas will be analyzed for 53 trace elements. A list of elements is presented in Table 11.

TABLE 11

TRACE ELEMENTS

Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Cerium
Chlorine
Chromium
Cobalt
Copper
Fluorine
Gallium
Germanium
Iron
Lanthanum
Lead
Lithium
Magnesium
Manganese
Mercury
Molybdenum
Nickel
Osmium
Palladium
Phosphorus
Platinum
Potassium
Radium
Rhenium
Rhodium
Rubidium
Ruthenium
Silicon
Silver
Sodium
Strontium
Sulfur
Thallium
Thorium
Tin
Titanium
Uranium
Vanadium
Ytterbium
Yttrium
Zinc
Zirconium

Progress during FY 74 includes (1) a literature search performed to expand EPA's knowledge regarding trace elements, (2) various analytical techniques reviewed for adequacy in our study effort, and (3) work of a similar nature performed by the TVA on the Allen Steam Plant near Memphis was reviewed. A complete report on the status of our trace element effort is included in the Work Group report to be published in June 1974.

3. Air Pollution Control Technology

An overview report on the present status of air pollution control technology for fuel conversion facilities is included in the June report. It discusses the types of control available, such as wet scrubbers, electrostatic precipitators, and fabric filters. Major equipment manufacturers are identified. Other techniques of control are also discussed, such as combustion modification. Pollutants of concern are particulates,sulfur oxides, nitrogen oxides, reduced sulfur compounds and hydrocarbons Sources of pollution discussed include power plants, coal gasification plants and coal liquefaction plants. Also, a special detailed report on coal gasification will be published.

Discussions with NERC-RTP have led to much of the accumulation of control technology information. Achievements to date consist of the accumulation and assimilation of a large bank of information regarding the control processes.

4. Interim Atmospheric Aspects Work Group Reports

   a. Regional Profile (Draft) Report (completed December 1973)

   b. Constraints (Draft) Report (completed December 1973)

   c. May 15, 1974 interim Work Group Report to Program Management Team (which will be placed in repositories with all NGPRP Work Group reports. Table 12 provides the table of contents of this interim report.

5. Proposed Fuel Conversion Facilities Development

Contact was made of utilities, state planning agencies, and State environmental officials in order to gather the most reliable data regarding the kind of and magnitude of development of fuel conversion facilities for the forseeable future. Estimated or projected capacities and locations of these facilities were obtained. Table 13 presents these data. A detailed discussion of these projected plants and their estimated atmospheric impact is included in this Work Group's report.

6. Point Source Modeling

Elevated point source air quality diffusion modeling was performed for eight regional coal fired power generating plants. Results of the modeling effort are detailed in the Work Group report and summarized in the June NGPRP interim report. Estimated impact from a coal gasification plant was also calculated and is reported in the Work Group report.

7. Coal Gasification Seminar

A seminar was held in Denver to acquaint government officials, industry and the public with the coal gasification process. Various processes were discussed. The proceedings of this seminar are being published and will be available from this office.

TABLE 12

OUTLINE

ATMOSPHERIC ASPECTS WORK GROUP INTERIM REPORT

May 1974

Abstract
Introduction
I. Regional Profile Report

Report on baseline atmospheric aspects of study area. Based on existing data.

1. Air quality (particulates, SO_2, NO_x, trace metals)
2. Meteorology (climate; topography (as it affects pollutant dispersion); mixing layer heights, visibility)
3. Emission inventory of point sources emitting greater than 100 tons/year of SO_2 and particulates
4. Complete list of power plants and related data, e.g., capacity; fuel used; emissions; and control devices used

II. NGPRP Air Quality/Meteorology Data Acquisition Network

1. Objectives of network
2. Site locations
3. Equipment used
4. Sampling frequencies
5. Data analyses

III. Revised Constraints Report

1. Clarification of significant deterioration
2. Expansion of "other environmental effects such as acid rain, solar radiation, etc."
3. Present report includes legislation, regulations, standards, financing, and manpower

TABLE 12 (Continued)

IV. Development Scenarios

  1. Projected power plants and gasification plants
  2. Projected NGP and State emissions
  3. Export activity
  4. Extractive industry emissions
  5. Secondary effect emissions

V. Diffusion Modeling

  1. Point source models to predict short and long-term pollutant concentrations arising from eight proposed NGPRP study area power plants: Sutherland, Nebraska; Colstrip, Montana; Center, Stanton, and Underwood, North Dakota; Kemmerer, Rock Springs and Wyodak, Wyoming.
  2. A detailed description of the point source and regional diffusion models to be used in post April '74 work and how the new NGPRP data will be factored into these diffusion models.

VI. Coal Conversion Alternatives

  1. Process efficiencies
  2. Process descriptions
     A. Direct coal fired power plant
     B. Coal gasification
     C. Coal liquefaction
     D. Coal cleaning

VII. Control Technology Overview

  1. Control equipment design parameters
  2. Processes for wet scrubbing
  3. Operational problems experienced to date
  4. Potential gasification plant controls

TABLE 12 (Continued)

VIII. Report Assessing State of the Art of Measuring Visibility

1. Schemes for measuring visibility will be investigated, e.g., those involving light scattering and extinction; photographic; visual.

IX. Trace Element Status Report

1. Discussion of present source sampling program

   A. Type Coal, trace elements concerned with analytical methodologies

2. Presentation of literature search data

   A. Analytical techniques

   B. Trace element effects

   C. Coal concentrations of trace elements

   D. Previous mass balance efforts - TVA

   E. Expected gasification trace element emissions

X. Future Activities

1. FY '75 and FY '76 activities of Atmospheric Aspects Work Group

2. Long term research needs.

TABLE 13

NGP Power Plant Summary

Installed Generating Capacity, Megawatts

	Existing (1)	Proposed (2)	Total
Montana	345	2,060	2,405
Nebraska	1,534	650	2,184
North Dakota	862	7,112	7,974
South Dakota	252	100	352
Wyoming	1,205	2,690	3,895
TOTAL	4,198	12,612	16,810

(1) In operation as of January 1, 1974 - Statewide

(2) Proposed construction through about 1984 - NGP study area

Future Activities

The Work Group activities are expected to require 4.0 work years in FY 75 followed by 2.75 work years in FY 76. Contracts in the amount of $580,000 in FY 75 and $126,000 in FY 76 are required. Upon completion of the final report in October of 1975, EPA will phase out of the NGPRP activities. It is hoped that the States will continue with some of the programs. Some of the activities, however, will continue to be supported by EPA under the auspicies of its energy-related program plans. Future activities are discussed below:

1. The Work Group will continue in FY 75 to take the lead in coordinating all air-related activities in the study area.

2. We will continue the collection and analyses of the samples obtained from the NGP ambient air monitoring network through FY 76.

3. We will continue the collection and reduction of meteorological data obtained at all meteorological stations through FY 76.

4. We will continue to compile data and information that will be used in writing the NGPRP final report and the special reports that this Work Group has identified as being appropriate. These special reports will discuss items such as control technology, coal gasification, trace element mass balances, and effects upon visibility.

5. The disturbance of land as a result of mining and related activities will cause an increase in the emissions of fugitive dust. In order to assess impact of these emissions on air quality, a study on a specific area will be designed. The background level should be assessed in an area prior to the start of a mining operation.

An air monitoring network will be designed using hi-volume samples to assess particulate concentrations in the immediate vicinity of a mining operation and at several sites at varying distances from the operation.

6. The Work Group will expand upon its trace element sampling program which was funded in FY 74. An intensive study will be planned to source sample a coal fired power plant in FY 75. Guidance from the FY 74 trace element sampling program will be utilized in order to narrow down the list of elements to be studied. An attendant intensive ambient monitoring program will be provided at the same time as the source sampling effort. This dual sampling effort should provide data with which to assess the adequacy of present diffusion models to predict trace element concentrations.

7. There is a need to identify the type and quantity of trace element emissions from coal gasification plants so that we may predict the atmospheric loadings and effects resulting from these plants. Bench scale and pilot plant studies are being performed on a couple processes in this country, but there is no work published on commercial plants, since the U. S. does not have any commercial sized plants. There is a need to study the European and/or African gasification plants. Research funds may be funneled through AGA or other avenues to perform source sampling programs on those plants. The NERC-RTP via CSL may be the vehicle for promoting these studies because of their substantial budget. However, Region VIII should have input to this activity in the form of suggestions to the type of work performed.

Also, a literature survey of the type of data available regarding these gasification plants will be performed.

8. A concern exists over the concentrations of trace elements in the respirable size range of particulate matter. The program carried out with FY 74 funds through Region VIII was not able to identify or characterize these data. An intensive sampling program will be performed on a single coal-fired plant to provide insight to this concern. This work may be performed in conjunction with item #6. This type of work would complement the work that has been performed by the NERC-RTP upon an Eastern coal fired power plant.

The AEC (Livermore Lab) is interested in participating in this type of program. It is conceivable that an interagency agreement could be entered into in order to conduct an extensive program.

9. A coordinated study will be conducted in the vicinity of a major coal fired power generating plant to assess the impact of emissions. The study will include an air quality monitoring network, a mass chemical analyses, and an evaluation of the concentrations in soils, plants and animals. This work may be performed in conjunction with item #'s 6 and 8.

The air quality monitoring network will sample the particulate and certain gaseous concentrations. Gases considered will include the criteria pollutants and other gases of general concern. The filters used to collect particulates will also be used to assess certain trace elements.

The concentration of trace elements in the soil, plants and animals will be correlated with the emissions coming from the plants. It is recommended that a cooperative arrangement be made with the State Game Commission for the animal studies. The study dealing with soils and plants could be coordinated with EPA research laboratories. Special attention will be given to the effect of sulfur oxide emissions on young plants, especially on land areas in the process of being reclaimed.

10. Little or no firm knowledge exists regarding the quantity of criteria pollutant emissions from gasification plants. Also, of significant interest are the magnitude and type of reduced sulfur compound emissions from these plants. The NERC-RTP is working on the development of emissions estimates and NSPS for gasification plants at the present time. It would be helpful for them to have actual emissions data from the commercial plants overseas. Region VIII input to this aspect of work will consist of keeping in close contact with what RTP is doing and making suggestions on the scope of work being followed.

Adequacy and extent of control technology is unknown for the present viable gasification processes. Region VIII will perform a literature search after consulting with RTP in an attempt to provide data on this topic.

11. The Work Group will expand upon its present diffusion modeling efforts. The availability of a model to predict regional air quality and long distance transport of pollutants is desirable. A case by case investigation of single emission sources will overlook the cumulative and interactive impacts of many sources within a region. Consequently, we will adapt an existing regional transport and diffusion model for use in the Northern Great Plains Region. This model will:

a. Be capable of being understood by decision-makers without technical expertise.

b. Have been tested with some verification data available.

c. Use readily available air quality and meteorological data.

d. Provide output which can be easily compared to air quality standards.

An additional longer term need is for the development of new, more refined regional air quality models which remove some of the simplifying assumptions of existing models. Some site specific verification is required.

12. The need for the development of methodologies to assess visibility and other impacts of increased sub-micron particulate loadings upon the atmosphere is apparent.

All available existing visibility data in the Northern Great Plains Region will be compiled. Airports and local observers are two possible sources.

Within the next year, an attempt at formulating a visibility assessment methodology will be made. Furthermore, the methodology will be tested at least at one site in the Northern Great Plains, for example Colstrip or Gillette. Data collection should occur before and after large power plants begin operation to assess the effects that increased particulate emissions have on visibility. Sampling ambient air for particulate particle size will accompany in-field visibility assessment.

13. The large-scale development of fuel conversion facilities in Region VIII will result in a significant increase of emissions. Substantial HC and NO_x emissions will occur. This situation plus the high frequency of sunlight in the NGP provides the excellent potential for photochemical oxidant formation. Also, it is suggested that presently the hydrocarbon and possibly the oxidant air quality standards are being exceeded in many non-urban locations. In order to assess the impact of the proposed development, this Work Group will locate some HC and oxidant air quality monitors in the region. This effort may be a part of the present NGP monitoring network and tied into the present contractural arrangement.

14. A requirement for wide-scale fluegas desulfurization (FGD) development is not anticipated in Region VIII unless State regulations (such as Colorado's) become more stringent than the NSPS, or if resolutions to significant deterioration mandate additional control. The amount of material to be disposed of is not as critical as the nature of the material. Collected flyash volume would not be much greater than the anticipated SO_3 or SO_4 sludge, but the chemical nature of the sludge could present a potential water problem.

Also, the capture and ultimate disposal of sludges containing possibly significant quantities of trace elements heretofore uncollected may require careful handling.

Utilization of sludge is being studied by NERC-RTP and others and should be followed and promoted.

Most of the work in this area will be in-house requiring manpower from Region VIII as well as RTP. Some contractual work is anticipated, possibly through expansion of ongoing work at RTP-CSL.

15. The quantity of emissions coming from an energy resource development area would indicate that health assessments should be scheduled both before and after the facility is operational.

A potential site would be the Crow or Northern Cheyenne Reservation in Montana. A number of samplers will be installed on the reservation and allowed to operate for several years as development takes place. This will allow for documenting impacts on air quality and human health over time as mines, power plants and gasification facilities become operational. The Indian Health Service could cooperate with health related aspects of study.

A second potential study would be a CHESS type study in an intensive development area such as Stanton. Since development is just starting, the study could acquire baseline information, if started immediately, and then track related health effects, if any, as development proceeds.

This would be a long-term study running perhaps 10 years.

16. The interplay of the Northern Great Plains Resources Program and recently promulgated federal and state regulations will be studied in detail. In view of recent promulgation of air regulations, indirect source regulations, 10-year maintenance plans and the soon to be promulgated significant deterioration regulations, the problem of energy resource development compatibility with such regulations should be evaluated in a systematic way. This will require an assessment of air sheds in the area, estabilishing air quality zones, and redesigning, if necessary, an air quality monitoring network to ascertain if the standards are achieved.

The compatibility of the energy resource development scenarios from the NGPRP to pertinent standards will be evaluated by employing point source and regional diffusion models. This effort could provide considerable information to the States in terms of siting guidance.

17. Effects upon health, vegetation, and visibility by SO_4 are not well understood. It is theorized that some concentrations may prove to be harmful. Due to the increased fuel conversion facility development in the NGP, an increase in particulate matter and SO_2 will result. Thus, we have the makings for sulfate production. Measurement of the SO_4 concentrations on all hi-vol filters in the NGP monitoring network would provide the data necessary to make some comments upon the trend of SO_4 levels in the atmosphere. Also, it will provide an important function by comparing the data to existing State standards. A long-term study is required (at least 10 years) in order to make meaningful conclusions.

18. Effects upon health, vegetation and visibility due to concentrations of nitrates and fluorides are not well understood. Nitrate and fluoride emissions in the Northern Great Plains will undoubtedly increase with the addition of new power and gasification plants. Therefore, it will be necessary to analyze the NGPRP high-volume sampler filters for nitrate and fluoride concentrations as well as sulfate and trace elements. Trend analysis is desirable and requires long-term sampling (at least ten years) in order to draw valid conclusions.

19. The task group will investigate the effect of an increase in cloud condensation nuclei upon the amount of rainfall. Several research studies have produced statistical support of both positive and negative effects of anthropogenic aerosols (e.g. from power plants) on precipitation. The difference in the conditions constituting a positive effect as compared to a negative effect have not been conclusively determined. Many new power plants and gasification plants planned for the Northern Great Plains area will produce considerable air emissions, some of which will become cloud condensation nuclei. The effect of the addition of significant quantities of these nuclei on precipitation in this region will be investigated.

20. Scientific theories have been advanced which predict profound effects upon the weather and climatological status of the earth. It is theorized on one hand that if CO_2 levels continue to increase as a result of combustion of fossil fuels, an increased trapping of infrared radiation will occur. This would result in a gradual heating effect and eventually cause the "greenhouse" effect. Increased CO_2 levels have been noted at the Mauna Loa observatory in Hawaii. On the other hand, it has been suggested that if the atmosphere is subjected to increased particulate loadings, the amount of solar radiation reaching the ground will be reduced. This would result in an "ice age" effect.

A long-term monitoring program would be necessary in order to make sound judgments on these two theories. At least 15 years of data would be needed to make any meaningful conclusions. CO_2 measurements should be made as a part of the NGP monitoring network in order to provide one or two data points for this trend analyses.

21. In order to verify the effects of increased atmospheric SO_2 loadings upon the pH of rainfall, extensive rain data and analyses would need to be performed. The key factors determining the pH of rain should first be identified. The chemistry should be discussed. This work group will provide substantial input to this research project. Also, a literature search regarding this subject especially looking at University thesis will provide some initial data.

Collection of rainwater along with routine analyses could be performed in conjunction with the NGP monitoring network.

22. EPA was recently directed to require states to address the question of the maintenance of air quality in the period beyond the original attainment dates specified in the State Implementation Plans (1975-77). To accomplish this, the states in Region VIII are designating areas which either currently exceed the standards or which have the potential to exceed the standards by 1985. In the coming year the state agencies, with EPA assistance, will be doing in depth analyses of these areas for the purpose of developing a "Maintenance Plan" for each

designated area. Because most of the Region VIII states contain large untapped sources of energy in the form of coal and oil shale, the Regional Office has encouraged the states to designate areas containing deposits of either as Air Quality Maintenance Areas (AQMA's). Maintenance plans will be developed for these areas in the coming year.

The information already generated by the NGPRP has been extensively used in the designation process; however, the level of sophistication of the analysis to be conducted in the next year will be much higher. Outputs from the NGPRP will be vital as inputs to the maintenance planning process for plans developed either by the states or by EPA.

Table D: Northern Great Plains Resources Program -- EPA Region VIII Accomplishment Plan

Atmospheric Aspects: Subject Area "D"

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
1. Continue Atmospheric Aspects Lead: Participate in overall air related activities and plan and monitor Work Group development. (Reg)	0.15	1.50	0.55	0.25
a. Attend meetings of Program Management Team and Work Group Leaders. Plan and attend atmospheric Aspects Work Group meetings.				
b. Meet with State and local government groups to explain atmospheric aspects portion of NGPRP and solicit their cooperation and support.				
c. Meet with industrial groups to explain work group activities and solicit cooperation and support.				
d. Invite participation of environmental groups with expertise in this area.				
e. Examine related ongoing and proposed government, industrial, and/or university regional atmospheric				

Table D (Continued)

Activity	Actual Activities FY 1973	Actual Activities FY 1974	Proposed Activities FY 1975	Proposed Activities FY 1976
1. e. (Continued) studies and try to incorporate within framework of NGPRP. Help coordinate efforts of research on atmospheric aspects of resource development.				
f. Coordinate activities with other work groups.				
2. Acquire and analyze air quality data from NGPRP sampling network. (Reg.)		0.30 $195,000	0.25 $50,000	0.05 $20,000
a. Collect data from high volume samplers; membrane samplers; particle size samplers; SO_2 and NO_x samplers.			data collection between June 1974 and July 1975	continued data collection at selected stations
b. Data reduction and analyses. Results submitted to Regional Office at monthly intervals.			data analyses between July 1974 and August 1975	
1. TSP mass concentrations.				
2. Trace element concentrations from the high volume and cascade impactor samplers.				
3. SO_2, NO_x concentrations.				
4. TSP particle size ranges.				
5. Sulfate, Nitrate, Fluoride concentrations from high volume samples.				

Table D (Continued)

Activity	Actual Activities FY 1973	 FY 1974	Proposed Activities FY 1975	 FY 1976
2. 6. Statistics, means, standard deviations, etc.				
c. Monitor progress of contracts.				
d. Contract funds to insure completion of data collection.				
3. Acquire and reduce meteorological data from NGPRP network. (Reg.)		0.20 $213,000	0.10 $80,000	0.05 $20,000
a. Collect data from pilot balloons; T-sondes, MRI surface weather stations, wind towers.			Continue met. network	Continue selected data stations
b. Data reduction and analyses. Submitted to Regional Office at monthly intervals.			Continued data reduction	
1. Digitized surface wind speed and direction data from MRI surface weather stations.				
2. AM and PM daily vertical temperature profiles.				
3. Joint wind speed-wind direction frequency distributions as a function of stability class and altitude. Printouts and computer tape.				
4. Reduced wind tower data - wind speed and direction.				

Table D (Continued)

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
3. c. Monitor progress of contracts.				
d. Contract funds to insure completion of data collection.				
4. Allowance for selected sampling stations to continue operation for more than one year. Continuation of monitoring effort at Colstrip past November 1974. States or EPA will operate stations. (Reg.)			0.10 $60,000	0.05 $20,000
5. Acquire visibility information for study area. (Reg.)		0.05	0.10	
a. Develop procedure for field work.			$60,000 contract	
b. Compile existing available visibility data, e.g. from airports.				
c. Assess visibility for various meteorological situations using in-field methodology at a selected site in the NGP study area.				
6. Perform a trace element mass balance around a coal-fired power generation plant. (Reg.)		$157,000	0.20 $75,000 contract	

Table D (Continued)

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
6. a. Identify a power plant upon which extensive source sampling may be performed. b. Particulate and gaseous samples will be obtained. c. A major facet of this sampling effort will be to collect particulate samples in various particle size ranges in order to determine if there is any enrichment of trace elements in the respirable size range. d. Coordinate study with other trace element studies that are planned or ongoing such as NERC-Corvallis or the AEC.				
7. Prepare status report on air pollution control technology. Keep abreast of recent developments in advancement of control techniques. (Region w/RTP assistance)		0.20	0.10 (0.05 NERC-RTP)	- (0.05 NERC-RTP)

Table D (Continued)

Activity	Actual Activities FY 1973	 FY 1974	Proposed Activities FY 1975	 FY 1976
7. a. The report should discuss in detail the following pollution control devices:				
1. Electrostatic precipitators				
2. Wet scrubbers				
3. Fabric filters				
b. The report should focus upon the following process:				
1. Power generation plants				
2. Coal gasification plants				
3. Coal liquefaction plants				
4. Uranium enrichment plants				
8. Participate in development of alternative strategies of study area.(Region)		0.05	0.05	0.10
a. Meet with government and private groups to determine planned or anticipated development in area.				
b. Incorporate information from (a) in development of development scenarios.				

Table D (Continued)

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
9. Estimate impact of resource development on air quality. (Region)		0.20	0.80 $50,000 adaption of existing regional diffusion model for NGP	0.70
a. Employ point source and regional diffusion models to make estimates on pollutant (TSP, SO_2, NO_x, trace elements) concentrations resulting from various possible schemes for resource development.				
b. Employ estimates from (a) to study problems of plant sitings.				
c. Employ estimates from (a) to study the issue of significant deterioration.				
d. Examine possible impact on air quality of secondary development related to resource development.				
e. Correlation between ambient sampling and mathematical diffusion model estimates.				
f. Estimate AQ impacts of mining activities.				
10. Continue preparing reports on atmospheric aspects of NGPRP. (Region)		0.25	0.35	0.50

Table D (Continued)

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
10. a. Interim reports.				
1. Regional Profile update incorporating NGPRP AQ/MET data.				
2. Special Reports				
3. Report on stack sampling and mass balance.				
4. Visibility Status Report.				
5. Modelling Status Report.				
b. Final Report on atmospheric aspects.				
11. Investigation of ambient levels of trace elements around coal-fired power plants. (Region)			0.05 $25,000 contract	
a. In conjunction with item #6 an extensive ambient sampling program shall be performed for particulates with analyses for certain trace elements.				
b. Verification of diffusion modeling results will be investigated.				
c. Site identification.				
d. Contract Administration.				
e. Evaluation of results.				

Table D (Continued)

	Actual Activities		Proposed Activities	
Activity	FY 1973	FY 1974	FY 1975	FY 1976
12. Identification of trace element and "criteria" pollutant emissions from coal gasification plants. (Region with RTP assistance)			0.10 (1 NERC-RTP) $60,000	0.10 (1 NERC-RTP)
a. A more complete set of knowledge must be obtained regarding coal gasification and coal liquefaction plants. Because of the vast number of gasification plants predicted to be constructed in the NGP in the extensive development scenario (42), the EPA must obtain better emissions data. All that we have available now is pilot plant studies or bench scale data.				
b. The type and adequacy of control equipment on coal gasification plants should be identified and discussed.				
c. A Region VIII contractual effort or expansion of the work contemplated by the NERC-RTP via CSL must be mounted during FY-75. This may include funding work to be done on the European plants, such as the Lurgi plant at Westfield, Scotland.				

Table D (Continued)

Activity	Actual Activities FY 1973	 FY 1974	Proposed Activities FY 1975	 FY 1976
13. Determine the photochemical oxidant formation potential in the NGP. (Region)			0.10 $40,000	0.10
a. In conjunction with item #12, a determination of the likelihood of photochemical oxidant formation should be made. This may mean an effort directed toward modeling.				
b. The added impact of a power plant in the vicinity of a coal gasification plant, in light of the significant HC and NO_x emissions from gasification should be assessed.				
c. A background HC and oxident sampling network should be established and maintained.				
14. Improved disposal methods or expanded utilization of solid waste from fuel conversion facilities should be studied. (Region with RTP assistance)			0.05 $10,000	0.05

Table D (Continued)

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
14. a. The amounts and chemical nature of solid waste from power plants, especially those with flue gas desulfurization, should be identified.				
b. The effects of disposal and/or utilization should be looked at.				
15. Determine the long term trends of effects of increased atmospheric loadings of CO_2 and particulate. (Region w/RTP assistance)			0.05 (0.05 NERC-RTP) $5,000	0.05 (0.05 NERC-RTP) $3,000
a. Establish two CO_2 monitoring stations in the NGP.				
b. In conjunction with item #2, monitor increased particulate loadings.				
16. Determine potential of acid rain. (Region with RTP assistance)			0.05 $5,000	0.05 $5,000
a. Search literature for chemistry of acid rain formation. Identify main constituents of acid formation.				
b. Conduct measurements of rain in the NGP. These measurements should be made for a few stations with the thought in mind of continuing over a long term, say 30 years, in order to get a trend analyses.				

Table D (Continued)

Activity	Actual Activities FY 1973	 FY 1974	Proposed Activities FY 1975	 FY 1976
17. Determine environmental effect of right-of-way grants. (Region)			0.05 $2,000	0.05 $10,000
a. Identify any harmful effects (primary and secondary) resulting from land cleaning and associated activities for transmission line, pipeline, or water ways routes.				
b. Monitor ambient air quality as deemed necessary.				
18. Determination of health effects in areas of energy conversion facilities development. (NERC-RTP coordinate; Region assist)			0.05 (0.90 NERC-RTP) $3,000	0.10 (0.40 NERC-RTP) $3,000
a. A study of the "before and after" health of individuals in the development areas should be conducted. A program similar to CHESS is desirable.				
b. This program, because of the nature, is necessarily long term in nature -- perhaps 10 years. A potential site would be near Stanton, North Dakota.			0.05 (0.90 NERC-RTP) $3,000	0.10 (0.40 NERC-RTP) $3,000

Table D (Continued)

Activity	Actual Activities FY 1973	FY 1974	Proposed Activities FY 1975	FY 1976
19. Correlation of health effects with ambient air quality levels in energy development areas. (Region with RTP assistance)			0.05 (0.10 NERC-RTP) $20,000	0.05 (0.10 NERC-RTP) $15,000
a. A monitoring network should be established on Indian lands to be separated and maintained by the tribe. The Crow or Northern Cheyenne Reservations in Montana are likely candidates.				
b. A health effects study similar in nature to item #19 should be conducted in conjunction with the ambient air quality monitoring effort described in 20a.				
20. Determination of effects of energy conversion development upon significant deterioration and maintenance areas. (Region)			0.05 $5,000	0.05 $5,000
a. Strategies for the designation of air quality maintenance areas should be developed taking into consideration the energy development being planned in the NGP.				

Table D (Continued)

Activity	Actual Activities FY 1973	Actual Activities FY 1974	Proposed Activities FY 1975	Proposed Activities FY 1976
20. b. Compliance with these air quality regulations will require information regarding siting of energy development facilities.				
21. Investigation of the increase in anthropogenic cloud condensation nuclei on rainfall in the Northern Great Plains. (Region)			0.05 $25,000	0.05 $25,000
22. Secretarial Support and Drafting (Region)		0.75	0.75	0.40
TOTAL: Regional (NERC) Work Years	0.15	3.50	4.00 (2.10)	2.75 (1.60)
Regional Contract Funds		$565,000	$580,000	$126,000

Surface Resources Work Group

(Work Group E)

Scope of Activities

Work Group E has been assigned the task of quantifying the surface resource values of the NGPRP area in terms of soils, vegetation, wildlife, and the uses of these surface resources. The group is also charged with the task of identifying land (surface) ownership in cooperation with the Minerals Work Group. We have urged that the Work Group continue to address the problems of restoration or rehabilitation of disturbed areas in a comprehensive fashion. The Work Group's work also includes the quantification and review of the impacts of such items as transmission lines and routes. Based upon these objectives, we have continued to allocate significant resources to activities within the scope of this Work Group.

It is necessary to insure a high degree of public participation in the work of this Work Group and to insure that the surface resources are reviewed from an ecosystem approach and not from just one of economy. Agricultural evaluations must review the appropriateness of crop use or grazing as well as the extent of and type of grazing or crop use. The Work Group must also provide an insight on the management of surface resources.

The Work Group is also faced with the difficult job of relating effects on varied surface resources such that some sort of overall evaluation may be composed of good and bad, desired and undesired, plus the undefined impacts of resource development.

Accomplishments

The Surface Resources Work Group, under the leadership of Dr. Otis Copeland, U. S. Department of Agriculture, Forest Service, has assumed the tasks of inventorying the major surface resources of the Northern Great Plains and of inventing various methods of comparing and evaluating the impact on these numerous surface resources. The Work Group has been subdivided into thirteen subgroups as follows:

1. Land
2. Soils
3. Vegetation
4. Fish & Wildlife
5. Recreation
6. Resource Development Potential
7. Agriculture
8. Wilderness
9. Scenery
10. Ecosystem Relationships
11. Forest Products
12. Surface Rehabilitation
13. Constraints

EPA is represented in the Fish and Wildlife Subgroup, the Rehabilitation Subgroup, the Recreation Subgroup, and the Ecosystem Subgroup.

The Work Group has prepared numerous maps which depict soil types, vegetation types, rainfall, the habitats of various wildlife species, and which combine certain of these data to project, for example, the relative ease or difficulty of revegetating disturbed lands (in terms of precipitation and soils type).

EPA coordinated an effort to complete a bibliography of information on rehabilitating disturbed land in the Northern Great Plains.

The Work Group and sub-work groups have had few meetings and therefore attendance cannot be used as a yardstick for participation. Much effort has been done independently with verbal coordination with the Program. EPA has arranged to provide an aerial photographic inventory of the strip mined areas (approximately twenty-five sites) so that all interested parties may adequately evaluate the surface impacts of such operations. The initial effort, that of scanning the existing satellite photography and lower altitude information, is being accomplished by the EPA Division of Field Operations in Denver. A low altitude photographic mission is scheduled by the EPA National Environmental Research Center in Las Vegas, Nevada, for June of 1974. A photographic inventory is scheduled to be published for each effort. Future flights have been proposed.

Future Activities

There are very important areas in which a Surface Resources Work Group type effort must be continued. There is also a five-year Department of Agriculture Project (Project SEAM) that is funding and directing research into the Surface Environment And Mining as it relates to coal and other resources. Depending upon the type of Northern Great Plains Resources Program that follows after June of 1974, EPA activities may be coordinated to varying degrees with either program, or may be semi-independent.

Some of the areas in dire need of additional investigation are: rehabilitation of disturbed lands, trace element fates in the ecosystem, ecosystem classifications, detailed soils surveys, monitoring of effects on surface resources, evaluation of alternative mine locations, legislative needs for adequate control of development, and land-use planning.

EPA activities through FY 75 and FY 76 are projected to require 1.0 and .5 man years respectively and to require, for adequate investigations, $110,000, and $87,000 for FY 75 and FY 76.

It is envisioned that EPA's NERC in Cincinnati will contribute at least 1 man year of effort toward this Northern Great Plains Program as a part of their contract direction and technical consultation related to coal mining in the West over the next two years. They are negotiating a contract with experts in the field of surface reclamation in order to gain a better understanding of the possible effects on and controls for reclamation that may prevent water pollution from the surface mining operation.

Table E. Northern Great Plains Resources Program -- EPA Region VIII Accomplishment Plan

Surface Resources: Subject Area "E"

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
1. Review of Work Group Work Plans, review of work products received from Group; general management; meetings; coordination of Work Group Activities with EPA regional coordinator; preparation of data; insurance of public participation; resources inventory - necessitates use of knowledge of ecology, biology and managerial.	0.04	0.25	0.15	0.10
2. Project Officer for demonstration grant to document strip-mine revegetation practices on a 100 acre plot in NGPRP area plus selected plots, analyses, and demonstrations on a smaller scale in geologically, hydrologically, or climatologically different areas. A five-year grant of $500,000 to cover direction, seeding, transplanting, etc., and documentation. Grading to be accomplished by other sources. Includes subsurface water quality monitoring.	0.02	(0.20 NERC-Cinn.) $100,000 grant	0.05 (0.20 NERC-Cinn.) $600,000 grant $30,000 contract	0.05 (0.30 NERC-Cinn.) $100,000 grant $10,000 contract

Table E (Continued)

Activity	Actual Activities FY 1973	Actual Activities FY 1974	Proposed Activities FY 1975	Proposed Activities FY 1976
FY 76-78 would involve continued documentation only. Requires agricultural, forestry, earth sciences, and landscape technical expertise with demonstrated managerial capability.				
3. Compilation review, evaluation, and strengthening (if necessary) of legal constraints/leases, permits, rules, regulations, laws, guidelines existing or needed to protect, conserve, or restore those surface resources of importance. Requires legal expertise.	0.02	0.10	0.04	0.02
4. Development and implementation of an "ecosystem" approach to the surface resources work plan along with public involvement in identifying and evaluating such systems. Requires an "ecologist" familiar with animal and vegetative ecosystem in particular.	0.02	0.05	0.05	0.02

Table E (Continued)

Activity	Actual Activities FY 1973	 FY 1974	Proposed Activities FY 1975	 FY 1976
5. Design and implementation of a surface resources monitoring system which may be used to monitor the condition of selected surface resources if development of coal continues. Inventory disturbed areas. May utilize remote sensing and, therefore, support from NERC-Las Vegas, and Hdqtrs. Expertise requirements are variable. Requires knowledge of measurable characteristics of surface resources.		0.10 (0.08 NERC-Las Vegas) $9,000 for aerial support	0.10 (0.50 NERC-Las Vegas) $20,000 contracts	0.05 $7,000 contracts
6. Provide coordination from the Surface Resources and ecological systems approach to the Siting Conference to be held in the region cosponsored by the NGPRP. Requires managerial capability.			0.05	
7. Assistance with the identification and quantification of public attitudes relating to the "development" of surface resources (including		0.04	0.08	0.04

Table E (Continued)

Activity	Actual Activities FY 1973	 FY 1974	Proposed Activities FY 1975	 FY 1976
the maintenance of the status quo) in and about the NGPRP area. Requires managerial capability.				
8. Analysis of the effects of airborne emissions from coal-fired plants on soils, vegetation, and animal systems.		0.10	0.10 $30,000	0.05 $70,000
9. Experimentation and evaluation of computerized plotting routines that may facilitate the planning of mines, mine mouth power plants, and land rehabilitation in cooperation with USDA Project SEAM.			0.02 $30,000 for contracts	0.01
10. Coordination of design of detailed soils surveys at potential development sites. Input to EIS reviews and preparation thereof.			0.01	0.01
11. Identification of correlations between trace element content of surface and near-surface waters, parent (rock) materials, soils, sediment, vegetative, and animal ecosystems.			0.05	0.05

Table E (Continued)

Activity	Actual Activities FY 1973	Actual Activities FY 1974	Proposed Activities FY 1975	Proposed Activities FY 1976
12. Secretarial - Clerk Typist support and other Technical Support.	0.04	0.05	0.03	0.10
TOTALS: Regional (NERC) Work Years	0.14	0.69 (0.28)	1.00 (0.70)	0.50 (0.30)
Regional (NERC) Contract Funds		$9,000 ($50,000 grant)	$110,000 ($300,000 grant)	$87,000 ($200,000 grant)

Socio-Economic And Cultural Work Group

(Work Group F)

Scope of Activities

Work Group F has been assigned the relatively complex task of identifying and quantifying many of the people-related aspects of the Program area as these aspects may control (to the extent of prohibiting) or be controlled by resources (primarily coal) and resource development in the area. In addition to determining present and future public opinion regarding both the current status of development and possible future status of development, this Work Group's assignment is considered to include quantification of that ill-defined parameter -- growth. The Work Group must carefully avoid over-emphasis of conventional economic analyses which, however useful and important, must be viewed on a one-to-one basis with social, scenic, aesthetic, and recreational values, all values that are extremely difficult to quantify.

Work Group F coordinates its activities with Work Groups C, D, E, and G.

EPA's involvement is primarily in the area assisting with and assuring that, the total potential environmental impact is evaluated and that the techniques developed to evaluate impacts are useful to the decision-makers and local interest groups. In general, there is a lack of a focal point for support of socio-economic and cultural activities, and EAP will try to have that role filled.

Much effort may be expended in the process of developing land-use tools that are integrated with the true impact on people. EPA will be involved in the definition of the extent to which impacts outside of the NGPRP area must be considered. Furthermore, EPA is making efforts to determine what are the environmental information needs of the decision-makers and local interest groups. The EPA Work Group "F" representative(s) will continue to help factor these needs back into the socio-economic work plan as well as the programs of other relevant task groups and will assist in the distribution of output from the task groups to the local interest groups.

For example, the State of Montana has projected a need for considerable effort, perhaps as much as $1,000,000 for up to five years of effort in surveying areas felt to fall within the scope of Work Group F. Thus, EPA must play a major role in coordinating the efforts of the Work Group with Montana and the other states in making certain that state participation and support of the states' involvement is achieved.

Accomplishments

As the Work Group charged with the task of identifying and evaluating possible social, economic, and cultural effects of resource development has, with difficulty, initiated several contract studies which begin to scratch the surface of this complex area. Under the direction of Frank Osterhoudt of the Economic Research Center, Department of Agriculture, various experts and Work Group participants have been asked to investigate primarily "site-specific" questions. Most of these relate to the social and economic impact of coal development in terms of impact on existing services or need for new services. Thus, for geographical areas of limited size, the Work Group will estimate the increases or changes in population, employment, income, taxes and other revenues, and how these factors may stress and support existing services and opportunities. The "site-specific" areas are (1) Rosebud and Custer Counties, Montana, (2) Oliver and Mercer Counties, North Dakota, (3) Sheridan and Campbell Counties, Wyoming.

Some relatively macroscopic economic analyses will be performed for the five-state area in terms both of the impact of coal mines and power conversion plants and of "spill-over" type population impacts, e.g., Black Hills, South Dakota tourism and secondary industry.

An effort is also planned to show the effects of coal mining and coal utilization in the Crow and Northern Cheyenne Indian Reservations. Another effort will be directed toward the investigation of the community impact of the cessation or decrease in mining.

Future Activities

There is a continuing need to coordinate, and redirect if appropriate, the various research efforts that fall under the umbrella of "Socio-Economic, and Cultural Studies". For example, the recently-initiated effort of the Denver Research Institute, under Office of Coal Research sponsorship, to predict people impacts for a large gasification/power generation complex in the Northern Great Plains, must be coordinated with region-wide activities throughout the coal area and should be based upon studies that meet the planning and evaluation criteria of the Northern Great Plains States.

The Socio-Economic Work Group also has the challenge to provide model legislation and regulations that enable the various levels of government to both quantify the probable impacts of regional coal development and to control the social, economic, and cultural effects to the degree desired.

EPA support of the Socio-economic Work Group effort is scheduled to increase in FY 75 to .4 man years of effort and continue through FY 76 at about .25 man years of effort. It is envisioned that contract funds in the amount of $100,000 will be required for both years to insure this area is not neglected.

Table F. Northern Great Plains Resources Program -- EPA Region VIII Accomplishment Plan

Socio-Economic and Cultural Aspects: Subject Area "F"

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
1. Managerial and coordination role in reviewing work plans and work products of the Work Group. Contact of public and other interest groups who will affect and who will be affected by mineral resources development to provide for quantification of opinions and their values. Requires managerial and socio-economic talent all modified by an active environmental awareness and concern.	0.03	0.02	0.10	0.08
2. Technical assistance in developing and producing documents that describe the possible impacts upon people of various development alternatives, including that of no development. Also the development of alternatives to minimize detrimental socio-economic and cultural aspects.		0.02	0.10 $100,000	0.10 $100,000
3. Preparation for and participation in the Siting Conference insofar as methods of evaluating socio-economic and cultural aspects are concerned, and as public opinion and polls are concerned, social scientist.				

Table F (Continued)

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
4. Investigation and assessment of regulatory framework and recommendations for improvement.		0.02	0.10	0.05
5. Assessment of public benefits derived from NGPRP and identification of alternative futures for NGP.		0.02 $25,000	0.05	
6. Secretarial Support	0.01	0.01	0.05	0.02
TOTALS: Regional Work Years	0.04	0.09	0.40	0.25
Regional Contract Funds		$25,000	$100,000	$100,000

National Energy Considerations

(Work Group G)

Scope of Activities

This Work Group has the primary responsibility for a critical quantification of the national and regional energy demand and the national and regional energy supply situation as this demand and supply situation may exist in the future. It is necessary for this Group to thoroughly review the accuracy of energy demand projections on a local and regional basis to document and publicize the reviews, and to give careful consideration to ways and means to reduce the demand. "Historical Perspectives" of energy demand figures must not serve as the only basis for projections of energy demand.

Work Group G had the initial tendency to staff with technical experts in fields such as power generation and electrical transmissions, emission control technology, and the like. This tendency must be countered by a strong dependence upon the other Work Groups for such technical data in order that Work Group G may concentrate on energy supply and energy demand. It is equally important for Work Group G to give equal time to regional energy demands as well as national demands, and to national energy supplies as well as regional energy supplies. Public participation is again critical to the success of the effort.

The regional director for EPA activities in the NGPRP serves as a principal participant in the activities of Work Group G in order, among other items, to insure the appropriate evaluation and presentation of regional considerations and regional perspectives. The work of this Work Group can be the most important and influential determinant of impact upon both the area of the NGPRP and EPA's Region VIII. Therefore, strong representation and participation by the regional office of EPA is considered mandatory. In view of the complex and interrelated issues, it is necessary for the regional coordinator to call upon most every area of expertise within the region.

It was initially envisioned that this Work Group would provide a lead in developing and implementing an information-disseminated system for NGPRP data. This activity may still fall under their scope of work. The initial Accomplishment Plan also identified this Work Group as a NGPRP leader in the organization of the Siting Conference.

Accomplishments

The National Energy Considerations Work Group has concentrated its efforts in the critical area of projecting the coal, electrical and synthetic natural gas (SNG) requirements for and of the Northern Great

TABLE 14

NATIONAL ENERGY CONSIDERATIONS WORK GROUP

NORTHERN GREAT PLAINS COAL SUPPLY PREDICTIONS

Trillion BTU

Scenario	Year	Production	Consumption	Export	% of National Energy Requirement
low	1985	2881	1632	1249	2.5
	2000	5436	3800	1636	2.8
intermediate	1985	1620			1.4
	2000	2164			1.1
high	1985	5730			4.9
	2000	14659			7.6

Million Tons

Scenario	Year	Production	Consumption	Export	% of National Energy Requirement
low	1985	192	108	84	2.5
	2000	362	252	110	2.8
intermediate	1985	108			1.4
	2000	144			1.1
high	1985	382			4.9
	2000	977			7.6

Table 15

NATIONAL ENERGY CONSIDERATIONS WORK GROUP

"HIGH SCENARIO" ASSUMPTIONS

1. Lowest estimated national gas imports from Canada

	deficit (10^9 ft^3)	
1980	1000	entire deficit to be made up by
1985	2100	synthetic gas -- ½ of this synthetic
2000	4000	gas from NGP

2. Nuclear Generating Capacity Lag

1985	20,000 MW
2000	240,000 MW

NGP coal is assumed to be used to fire stations in electric reliability councils bordering the NGP. All additional coal tonnage to fire fossil stations to make up this amount of power added to export sector. (For the sake of clarity, Regional generating capacity was held constant.)

3. Oil Import Shortage

1985	3×10^6 barrels
2000	5×10^6 barrels

50% of fossil plants using oil switch to coal. Those in geographically neighboring electric reliability councils will use NGP coal. All additional coal requirements added to export sector. (For the sake of clarity, Regional generating capacity was held constant.)

Plains. EPA has not been closely involved with this Work Group, since most operations have been carried out in Washington, D.C. We have had the opportunity to review the Nov., 1973 and May, 1974 drafts of the Work Group report. The majority of the Work Group effort has been carried out under the direction of Mr. James West and Mr. Walt Dupree of the Department of Interior. The Regional VIII office of EPA is represented on the Work Group, as is the Research and Development Office of EPA Headquarters. The Region VIII office of EPA also collected data on new plants in order to identify all existing and proposed coal development activities.

The Work Group report and supplemental efforts have produced both a tabulation of past energy demands made upon the Northern Great Plains region, by Sections (Residential and Commercial, Transportation, Industrial, Electrical Generation) and a projection of future demands for the years 1985 and 2000. The demands are based upon three sets of projections as to how the Northern Great Plains coal will be used to satisfy a projected national need. A relatively low level of production of energy in 2000 from Northern Great Plains coal is projected where 1.1 percent of the national energy requirements is supplied by that coal, a higher or moderate level ("Intermediate Forecast") is assumed by 2000, where 2.8 percent of the national energy requirements are supplied by that coal, and a very high level (high scenario) where 7.6 percent of the nation's energy requirements are satisfied by Northern Great Plains coal in the year 2000. These three demands require 144 million tons, 362 million tons, and 977 million tons by the year 2000, respectively. The three sets are thus assumed levels of energy production, or requirements, of the Region and serve as bases for further analysis by the six other Work Groups. See Tables 14 and 15.

Major questions have arisen regarding the derivation of both the projection of national energy requirements and the levels selected for the Northern Great Plains. Many such questions result from the complexity involved in projecting public demand for energy and policies relating to supply of that energy. Further complicating the complex calculation is the recent decrease in oil imports and a trend of energy conservation or energy use reduction seldom experienced in the past.

Future Activities

Since the projections made by the National Energy Considerations Work Group are essential to comprehensive planning of coal and other resource use in the Northern Great Plains, these projections should be constantly updated. Further, the projections should be thoroughly explained, regionalized, and the consequences of various choices portrayed. As one example, the possible effects of continued shortages of crude oil, as well as reduced usage of gasoline, should be factored in varying formats.

Within the scope of this Work Group's efforts are also the deliberation over and delineation of possible mixes of energy supplies from the varied sources of energy. From Region VIII's viewpoint, it is important that these studies be applicable to the energy choices of the West. It may be most appropriate to establish the Work Group in the regional area as opposed to Washington, D. C. such that this objective can be achieved.

EPA has projected a total of .5 work years for its efforts in this Work Group during FY 75 and .2 work years during FY 76. No funding requirements have been itemized, however, we consider that EPA as a whole will be funding related and useful efforts in this area.

Table G: Northern Great Plains Resources Program -- EPA Region VIII Accomplishment Plan

National Energy Considerations: Subject Area "G"

Activity	Actual Activities		Proposed Activities	
	FY 1973	FY 1974	FY 1975	FY 1976
1. Identification and construction of energy supply projections based upon all resources found in region and summary of energy-supply technologies and their impact.		0.25	0.10	
2. Identification and construction of energy demand projections for sectors, regions, and nation.		0.25	0.10	
3. Analyses of Demand-Supply system, including the system of reducing demand.		0.25	0.20	0.10
4. Identification of mixes of energy fuels.		0.10	0.05	0.05
5. Secretarial Support		0.25	0.10	0.05
TOTALS: Regional Work Years		1.10	0.50	0.20

V. Summary

This Accomplishment Plan has been prepared to serve as a guide for the Region VIII offices of the Environmental Protection Agency as the Northern Great Plains Resources Program progresses. The Program was precipitated by the increased activity occurring in Montana, North Dakota, South Dakota, and Wyoming associated with the extraction and utilization of "low sulfur" coal. The Program is designed to procure and develop information that can assist in either developing the coal resource or restricting such development, depending upon the outcome of comparisons of the desired and projected results of "development".

Since mining and burning of some 35×10^9 metric tons[25] of strippable coal from the sparsely populated area of the Northern Great Plains would significantly alter the environment, the EPA must assure that those responsibilities delegated to it, especially the responsibilities to prevent pollution, to assist the States, and to involve the public, are incorporated in the decision-making process that is the forerunner of large-scale mining. Though only 5×10^5 hectares of land are essentially committed to coal mining in the Northern Great Plains, the area affected could increase by two orders of magnitude. Fortunately, a moratorium has been placed on issuance of Federal Prospecting Permits. Few power plants of size have been established in the area, though one study projects as many as forty-two new coal-fuel steam-electric plants in the coal-rich area. The time to evaluate the proposed development is now.

The Northern Great Plains Resources Program provides the framework within which EPA can discharge its responsibilities while making maximum use of other Federal, State, and local resources. The Program also gives the framework to evaluate coal in light of and as it affects other resources, including the reserves of other energy fuels contained in Region VIII.

The detailed Tables, RD and A through G, of this Plan propose the continuation of an interdisciplinary effort spearheaded by the Region VIII office to provide the quantitative analysis of questions and issues (the latter which may be viewed as the more important question) that arise as decision-makers at all levels of government strive to plan for and regulate coal and associated "development" in the Northern Great Plains States. Based upon our experiences through the past year and those activities that are outlined in those Tables, we have estimated that 12.0 work years of effort will be spent by the Region VIII office in activities directly concerned with this Northern Great Plains Resources Program -- through FY 75. In order that we may continue to fill the need for support of short-term research, monitoring, and other investigations, it has been proposed that we continue to provide contract funds for the tasks described in the Tables in the amount of about 1.2 million dollars. This continued support is essential to the Program.

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[25] "High" Scenario production for 35 years.

The continued full-time assignment of EPA personnel to the Program (approximately seven positions) is considered mandatory for the success of EPA's activities. As the only Program participant able to arrange its staff in a manner such as that described in this Plan, EPA has developed a high degree of credibility in its activities over the past year.

The Headquarters allocation is based upon the tentative identification of individuals who either themselves or through their staffs will participate in the Program effort. These efforts will be largely conducted without regional coordination.

It is important to note that those familiar with similar efforts, including EPA's efforts in Interior's Oil Shale Program, are convinced that the position of regional coordinator is critical to the successful implementation of EPA's role in the Northern Great Plains Resources Program, and that the ability of this coordinator to accurately weigh the many factors extant in such a series of dilemmas is required.

We have always recognized that the descriptions herein and previously published regarding our activities have contained a high degree of emphasis on what some would term the "technical" aspects of an assessment of impacts or effects of coal "development". But throughout the design of the effort, it has been recognized that the data or analytical methodologies will be useless unless implementable and implemented. During this second and likely last year of extensive funding by EPA into the Program as such, our activities must emphasize the use of the data produced for viable regional planning and regulation. Investigative activities will have to be conducted to answer specific questions or issues the answers to which define policy. The Program is not to develop the policy -- that is the perogative and responsibility of the various levels of government organized by law. However, there is obviously a very fine line between answering questions and developing policy.

The region must also develop upon the foundation already laid to coordinate research into areas that relate to an assessment of the impacts of coal development. If Project Independence funds become available, the need for such coordination will increase even more. Such coordination has as its theme the transfer of hypotheses and results produced by research to the decision-makers before it is too late to use the data. This is particularly important in the rapidly-developing field of energy production in the western United States.

Table 16

Work Group Subject Area	FISCAL YEAR 1973 (Apr - Jun)					FISCAL YEAR 1974				
	Regionally-Coordinated Effort		Hqs. Effort		Regional Contract Funds	Regionally-Coordinated Effort		Hqs. Effort		Regional Contract Funds (Obligated)
	Work Years (Actual)	Salary, Support* (Estimated)	Work Years (Estimated)	Salary, Support* (Estimated)		Work Years (Actual)	Salary, Support* (Estimated)	Work Years (Estimated)	Salary, Support* (Estimated)	
RC - Regional Coordination	0.25	$ 6,250	0.35	$ 8,750	--	1.50	$37,500	1.50	$ 37,500	$ 26,000
A - Regional Geology	0.04	1,000	--	--	--	0.15	3,750	--	--	10,000
B - Mineral Resources	0.18 (Incl. 0.04 NERC-Cinn.)	4,500	0.05	1,250	--	1.71 (Incl. 0.59 NERC-Cinn.)	42,750	0.50	12,500	15,000
C - Water	0.30	7,500	0.05	1,250	--	4.15 (Incl. 0.30 NERC-Corv.)	103,750	0.75	18,750	150,000
D - Atmospheric Aspects	0.15	3,750	0.05	1,250		3.50	87,500	1.25	31,250	565,000
E - Surface Resources	0.14	3,500	--	--	--	0.97 (Incl. 0.28 NERC-Cinn; 0.08 NERC-LV)	24,250	--	--	9,000
F - Socio-Economic and Cultural Aspects	0.04	1,000	--	--	--	0.09	2,250	0.25	6,250	25,000
G - National Energy Consideration	--	--	0.10	2,500	--	1.10	27,500	1.50	37,500	--
TOTALS:	1.10	$27,500	0.60	$15,000	-0-	13.17	$329,250	5.75	$143,750	$800,000

* Based on $25,000 per work year.

TABLE 17

Work Group Subject Area	FISCAL YEAR 1975					FISCAL YEAR 1976				
	Regionally-Coordinated Effort		Hqs. Effort		Regional Contract Funds	Regionally-Coordinated Effort		Hqs/ Effort		Regional Contract Funds
	Work Years Projected	Salary, Support Projected	Work Years Projected	Salary, Support Projected	Projected	Work Years Projected	Salary, Support Projected	Work Years Projected	Salary, Support Projected	Projected
RC - Regional Coordination	1.40	$ 35,000	1.50	$ 37,500	$ 21,000	1.00	$ 25,000	0.70	$17,500	$ 10,000
A - Regional Geology	0.10	2,500	---	--	--	0.05	1,250	--	--	--
B - Mineral Resources	2.44 (Incl.1.4 NERC-Cinn. 0.04 NERC-RTP)	61,000	0.50	12,500	105,000	2.15 (Incl.1.40 NERC-Cinn.)	53,750	--	--	60,000
C - Water	6.10 (Incl.2.5 NERC-Corv.)	152,500	0.75	18,750	240,000	4.00 (Incl.2.5 NERC-Corv.)	100,000	--	--	180,000
D - Atmospheric Aspects	6.10 (Incl.2.10 NERC-RTP)	152,500	1.25	31,250	580,000	4.35 (Incl.1.60 NERC-RTP)	108,750	--	--	126,000
E - Surfaces Resources	1.70 (Incl.0.20 NERC-Cinn. 0.5 NERC-LV)	42,500	---	--	110,000	0.80 (Incl.0.30 NERC-Cinn.)	20,000	--	--	87,000
F - Socio-Economic and Cultural Aspects	0.40	10,000	0.25	6,250	100,000	0.25	6,250	--	--	100,000
G - National Energy Considerations	0.50	12,500	1.50	37,500	--	0.20	5,000	0.50	12,500	--
TOTALS	18.74	$ 468,500	5.75	$ 143,750	$1,156,000	12.80	$320,000	1.20	$30,000	$563,000

* Based on $25,000 per work year

APPENDICES

APPENDIX 1	OUTLINE OF PLAN - NORTHERN GREAT PLAINS RESOURCES PROGRAM
APPENDIX 2	REGION VIII RECOMMENDATIONS ON PUBLIC INVOLVEMENT AND PARTICIPATION IN THE NGPRP
APPENDIX 3	EPA STATUTORY AUTHORITY FOR NGPRP PARTICIPATION
APPENDIX 4	NORTHERN GREAT PLAINS RESOURCES PROGRAM "LONGER TERM STUDY AND DATA NEEDS"
APPENDIX 5	SITING CONFERENCE
APPENDIX 6	MONTANA STRIP MINING AND RECLAMATION ACT

APPENDIX 1

OUTLINE OF PLAN

NORTHERN GREAT PLAINS RESOURCE PROGRAM

JANUARY, 1973

(as prepared by originators of the interagency program)

Introduction

"The Northern Great Plains, an area which consists of large segments of Montana, Wyoming, North Dakota, South Dakota, and Nebraska, has been the focus of increasing attention because the area is a potential source for vast amounts of relatively low sulfur coal. Interest in the development of the Northern Great Plains coal resources stemmed primarily from the continuing growth of national energy consumption and increasing emphasis on improved urban air quality.* The possibility of large scale development of the coal reserves has, at the same time, heightened regional concern for effective land use and resource planning; including such issues as environmental quality, mined area reclamation competition for scarce water resources, development of other mineral resources, and potential effects on the people and economies of the Northern Great Plains States.

"The local, state and Federal governments which make land use and resource planning decisions affecting the area face competing economic, social, and environmental alternatives. The Federal government continues to make decisions regarding leasing schedules for coal resources on public and Indian lands, regulations for air and water quality, and development of water projects. Congress is considering several measures related to surface mining. The States also are concerned with resource development; many have considered or taken legislative action related to surface mining and have prepared State Implementation Plans for air quality under the Clean Air Act. Local governments promulgate zoning and land use plans, and provide for essential public services. Regional Commissions for economic development and water supplies share similar concerns and responsibilities. Local, state, regional, and national interests are not well coordinated at this time.

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* Author's note: While interest originally stemmed from growth of energy consumption and the desire to improve air quality, renewed interest may be attributed to the more recent restrictions on oil imports to the United States.

"These factors have led the five States, the Old West Regional Commission, and several Federal agencies to cooperatively initiate the Northern Great Plains Resource Program (NGPRP). This document sets forth the objectives, design outline and organization of the program.

Objectives

"The primary objective of the NGPRP is to provide an analytical and informational framework for policy and planning decisions at all levels of government. The end result is intended to be a decision-making tool for Federal, State and local interests who together must plan and manage the area's land and natural resources.

"The principal issue concerns the development, or nondevelopment, of land resources within the Powder River and Fort Union areas. Particular emphasis is placed on coal resources. The program will provide data and analytical methodology, including the development of appropriate models, to demonstrate the economic, social and environmental consequences of various courses of action. The program will present both quantifiable and nonquantifiable implications of alternative land and resource uses. The final report will not recommend a particular development plan for the region, rather, it will provide adequate information on the balancing of values and net benefits of alternative plans to guide development of a coordinated Federal-State plan.

"The second objective is to encourage the organization of ad hoc institutional entities that will bring together all facets -- local, State and Federal -- concerned with collection and interpretation of information which will affect the future development and quality of the region. It is anticipated that this will lead toward a coordinated planning program for the entire region. The organization would draw from existing State-Federal mechanisms for socio-economic planning in the region, such as State planning groups, Title V Commission, and appropriate River Basin Commissions. Policy and decision-making authority must be retained by established agencies, organizations, and the State and local entities. The NGPRP will contribute in every possible way to encourage this coordination.

"A third objective is provision of a coordinating link between data collection, research, planning and operational resource management activities that exist within many different organizations. Such a link should assure rapid interchange of technology and methodology between individual programs associated with the NGPRP.

Scope and Guidance

"All analyses will deal with the implications of proposed resource management actions for the five-state area. Although focus will center on the study area, and particularly Powder River and Fort Union resources, the program will adopt whatever appropriate perspective for each subject of analysis. For example, analysis of energy requirements will consider the national energy situation and its principal geographic components, as well as other demands for Great Plains coal.

"Thus, an alternative to delayed development of coal or other minerals will be considered in relation to impact on the local economy, as well as impact on the esthetic and cultural values of the region, and relation to the National energy situation. Likewise, in considering energy development cases, analyses of air quality, for example, will include implications of electrical generation in distant urban areas as opposed to generation in the study area, as well as the relative effects of each on local air quality. These two examples are meant to illustrate the wide range of concerns within the NGPRP.

"The program will foster integrated consideration of basic natural resource use and protection, including human interests and economic and social development. It will consider the full range of economic, social, and environmental consequences of alternative plans of land and resource management in the region. The accumulation of knowledge and analysis techniques has implications which extend beyond the study area and into other areas of the country that are confronted with similar problems. The resultant data may become a model for future studies or programs concerned with resources in other areas.

"To the fullest possible extent all concerned entities will have the opportunity to participate in the design and implementation of the program. Vehicles for participation and use of study results will include frequent reports, regular briefings of broad-based advisory personnel, direct participation in work groups when appropriate, and the periodic assembly of policy officers from involved local, State and Federal agencies, concerned individuals, and representatives of special interest groups, to discuss issues, alternatives, and possible joint regional policies.

"The program will provide an objective display of data and analysis to allow a user to draw conclusions based on his particular value system.

The Program

"The NGPRP will consist of a series of investigations and studies dealing with a common theme, rather than a single area of concern. The over-all study will be time-phased and, although a comprehensive final summary report will be issued, study results will be reported as they are completed. A schematic of the timing sequence is shown in Figure 1; specific dates and tasks are not included; that will be one of the study's first steps. Frequent and timely reporting will provide maximum assistance to decision-makers on issues which often cannot be delayed until a full, final report is issued.

"The program has five principal sections: (1) program design, (2) regional profile, (3) constraints and alternate strategies, (4) analyses of consequences, and (5) preparation of a final report.

"1. Program Design. The first step of the program will be to submit this preliminary outline to other Federal agencies, States, industry, and interested citizens for review. The preliminary outline will then be expanded into a Program Design document which will discuss at length the nature of the data and methodology to be used, and will elaborate on the tasks and structure of the effort.

"The draft Program Design will then be reviewed with other Federal agencies, States, regional commissions, and the public. Such review should be expedited, but data collection and the assessment and development of analytical techniques can begin simultaneously. Comments on the draft Design will be further solicited directly from interested parties through the mechanism of Advisory Committees (discussed below under Organization), and the Program Design will be the basis for an expression of views if public hearings are held. Final approval of the Program Design will be the responsibility of the Program Review Board.

"The Program Design should be an evolving document rather than a fixed statement or work plan. The Program Management Team will continually modify its concepts, and refine ideas and tasks on the basis of experience gained and suggestions from co-workers and users during the course of the study.

"2. Regional Profile. Data will be collected and analyzed on: (a) physical characteristics of the region, (b) resources, such as minerals and fuels, wildlife and fisheries, scenic and recreational areas, timber, agricultural products and water -- including their location, current use, ownership and control, (c) present baseline environmental quality, including data on solid waste generation and disposal, (d) regional infrastructure, (e) population density, distribution, and character, (f) regional social and economic attitudes, and (g) past and present activity. In short, complete ecological, natural resource, social, and economic inventories will be developed, as specified in the Program Design phase. Inventory will begin with a review of the available data, will identify gaps and then recommend collection of data to fill those gaps. As data are gathered, they will be published. Preliminary investigations should examine the need for maps to display land use and ownership, water, minerals, and other resources.

"3. Constraints and Alternative Strategies. To provide a basis for judging the feasibility of development and management alternatives, it will be necessary to identify and evaluate legal, institutional, social, economic, environmental, and physical constraints on resource development and management. The analysis of physical constraints will include, for example, the need to commit or divert a resource such as water, for the development of coal. Existing arrangements may limit the extent to which this can be done.

"As such constraints are identified, findings will be fed into other program elements to avoid duplication. This will be accomplished by continual monitoring of all tasks by the Program Management Team. Some of this monitoring and feedback also will be a function of the Technical Advisors. These studies should also identify development stimuli. (See following section on Organization.) Because this is the phase of the study in which exercise of judgment is inevitable and the possible loss of objectivity is most likely, it may prove to be most crucial. It is, in effect, an inventory of institutions and attitudes. The relevant institutional constraints are readily identified -- The Clean Air Act, National Environmental Protection Act, mine reclamation laws, regional water compacts, mineral leasing laws, other related State and Federal laws, land ownership, and the like. Equally important are economic and social constraints on resource management alternatives. A variety of attitudes and views must be surveyed and considered.

"The output of the constraints section would be, in effect, an identification of potential issues and an improved definition of alternative goals, such as maximum contribution to the solution of the U.S. energy problem. The analysis may help redefine specific goals consistent with the requirement that the NGPRP study not select a single goal or system of values, and thus prejudge results.

"To produce more detailed analyses of the implications of resource management and development alternatives, general alternative management and development strategies must be postulated. One strategy should assume no further development beyond that presently underway; that is, to maintain the status quo. Additionally, several strategies should be developed to represent a range of rates and intensities of development in the region. Possibilities might include shipping mined material out of the region for processing; mine-mouth generation of electricity with coal, gasification and on-site burning of gas, or pipeline transport of coal gas to distant use sites. Other models could concentrate on consequences of favoring surface use such as recreation and ranching, rather than mineral development. The alternative of generating power within the study area, and using it for such processes as uranium enrichment, must be considered in light of both economic and environmental implications. Possible new electrical transmission methods must be considered in any model concerned with mine-mouth generation of energy.

"Strategies should include not only the physical management and development of the resources of the region, but also concomitant actions that various levels of Government and industry may have to take, such as regulation, leasing or investment. All strategies or options must consider total resource management in the region. Relationships of the proposed development strategies to regional and national demand and supply projections must be analyzed. That can perhaps best be accomplished through econometric and other appropriate models.

"4. Analysis of Consequences. The proposed strategies will be analyzed to determine economic, social and environmental implications locally, in the region, and nationally. These implications will be arrayed against a variety of goals and the results presented without value judgment. The multi-objective principles and standards being developed by the Water Resources Council will be reviewed and applied to the extent possible.

"To perform these tasks, an array of analytic methodologies and/or models shall be identified, evaluated, and extended, or developed as needed. These models must address such diverse effects as national economic patterns, regional and State economic status and development activities (econometric models), air quality (emission and meteorological models), land use, and resource use. Modeling and regional profile inventories shall be closely coordinated, should proceed in a parallel manner, and should be carried out by the same people. In addition to detailed models of specific sectors, integration of sector models will be required. This will be a particularly delicate task, but necessary to provide a means of translating alternatives regarding limited areas into a comprehensible whole. The need to establish methods for assuring crosswalks between various models cannot be overemphasized.

"This array of models, when fully developed and integrated, will themselves be a major product of the program and should be useful for resource planners in other areas, as well as planners in the study area who may need to further evaluate development proposals.

"5. Final Report. Assuming resource and use inventories, analytical methodology, and interim results are published as they are developed, the final report will consolidate results and provide a readable overview of the program.

Organization and Participation

"A schematic of the proposed organization is shown in Figures 22 and 23. Policy guidance and overall direction will be provided by a high-level Program Review Board, which will have ultimate authority over the Program. Day-to-day direction will be in the hands of the Program Management Team. The Program Manager will frequently report to the Program Review Board. Other Federal agencies and State, citizen, and industrial organizations will advise the Program Review Board. Individual advisors will be designated or approved by the Review Board. Advisory Groups, as well as interested private entities may also desire to exchange information with the Program Management Team and participate in the working groups. Such participation will be encouraged to the fullest possible extent.

"Implementation of the program will be the responsibility of a Program Management Team, consisting of one representative from each of the major participating agencies. The Program work will be carried out by a cross-section of full and part time staff under the overall direction of the Program Management Team.

"The Program Management Team will assume direct responsibility for preparing the Program Design and Final Report. The remainder of the Program will be coordinated by three Staff Coordinators, who will report to the Program Management Team. Their areas of responsibility will be the development of the Regional Profile and of Constraints and Alternative

FIGURE 22

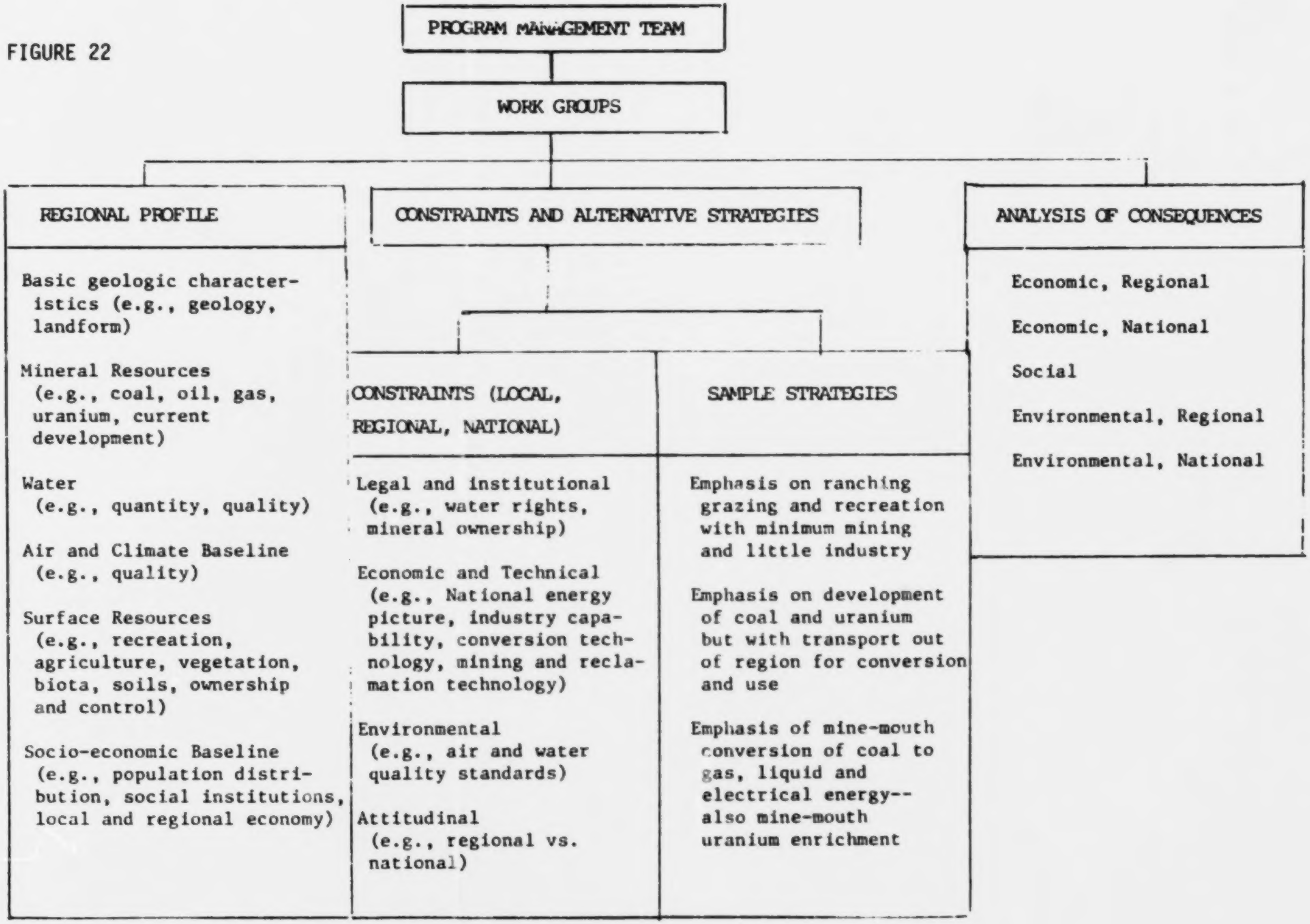
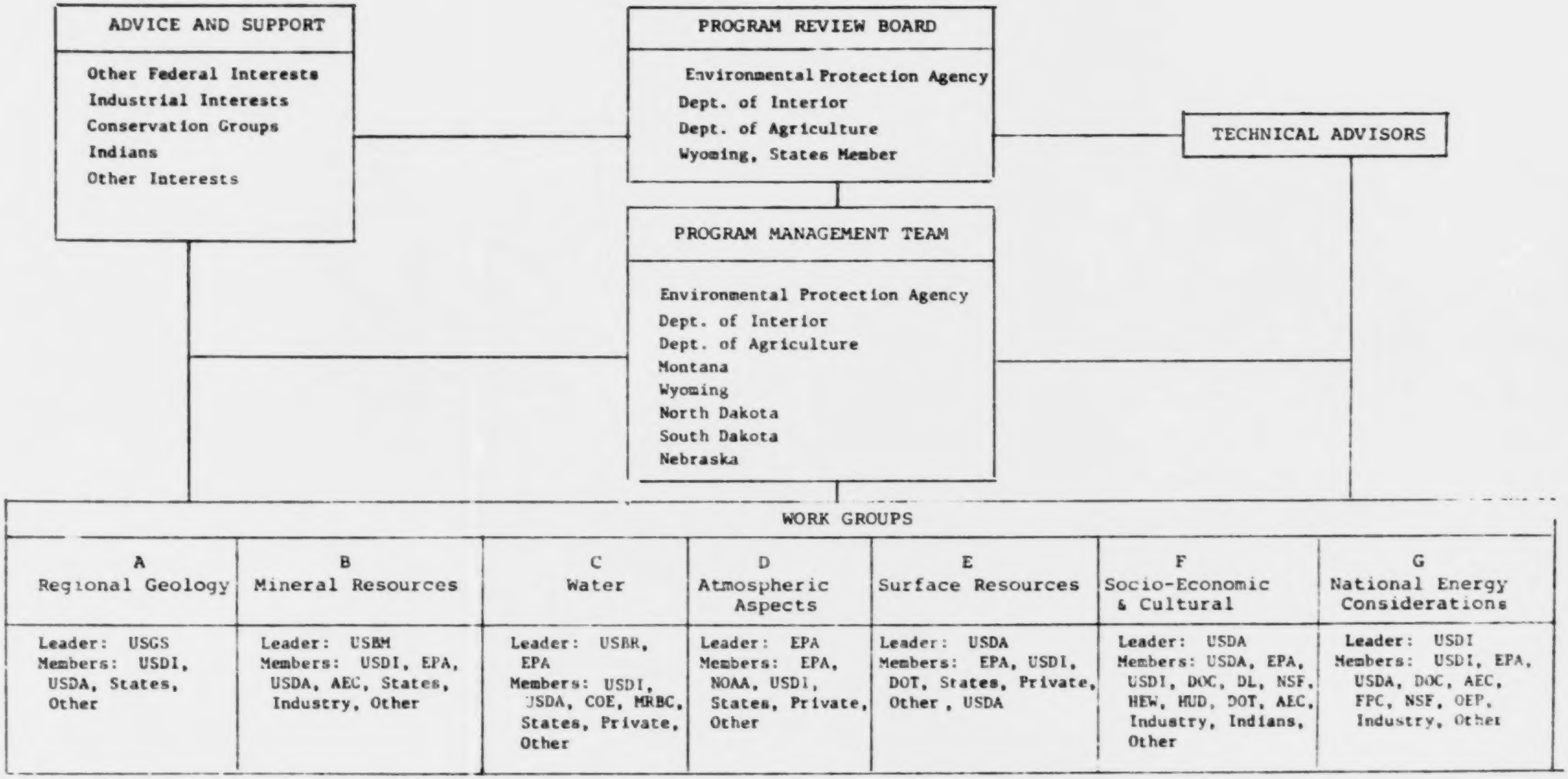

PROGRAM MANAGEMENT TEAM
WORK GROUPS
REGIONAL PROFILE
Basic geologic characteristics (e.g., geology, landform)
Mineral Resources (e.g., coal, oil, gas, uranium, current development)
Water (e.g., quantity, quality)
Air and Climate Baseline (e.g., quality)
Surface Resources (e.g., recreation, agriculture, vegetation, biota, soils, ownership and control)
Socio-economic Baseline (e.g., population distribution, social institutions, local and regional economy)
CONSTRAINTS AND ALTERNATIVE STRATEGIES
CONSTRAINTS (LOCAL, REGIONAL, NATIONAL)
Legal and institutional (e.g., water rights, mineral ownership)
Economic and Technical (e.g., National energy picture, industry capability, conversion technology, mining and reclamation technology)
Environmental (e.g., air and water quality standards)
Attitudinal (e.g., regional vs. national)
SAMPLE STRATEGIES
Emphasis on ranching grazing and recreation with minimum mining and little industry
Emphasis on development of coal and uranium but with transport out of region for conversion and use
Emphasis of mine-mouth conversion of coal to gas, liquid and electrical energy--also mine-mouth uranium enrichment
ANALYSIS OF CONSEQUENCES
Economic, Regional
Economic, National
Social
Environmental, Regional
Environmental, National

FIGURE 23

NORTHERN GREAT PLAINS RESOURCE PROGRAM (NGPRP)


ADVICE AND SUPPORT
Other Federal Interests
Industrial Interests
Conservation Groups
Indians
Other Interests
PROGRAM REVIEW BOARD
Environmental Protection Agency
Dept. of Interior
Dept. of Agriculture
Wyoming, States Member
TECHNICAL ADVISORS
PROGRAM MANAGEMENT TEAM
Environmental Protection Agency
Dept. of Interior
Dept. of Agriculture
Montana
Wyoming
North Dakota
South Dakota
Nebraska
WORK GROUPS

A Regional Geology	B Mineral Resources	C Water	D Atmospheric Aspects	E Surface Resources	F Socio-Economic & Cultural	G National Energy Considerations
Leader: USGS Members: USDI, USDA, States, Other	Leader: USBM Members: USDI, EPA, USDA, AEC, States, Industry, Other	Leader: USBR, EPA Members: USDI, USDA, COE, MRBC, States, Private, Other	Leader: EPA Members: EPA, NOAA, USDI, States, Private, Other	Leader: USDA Members: EPA, USDI, DOT, States, Private, Other , USDA	Leader: USDA Members: USDA, EPA, USDI, DOC, DL, NSF, HEW, HUD, DOT, AEC, Industry, Indians, Other	Leader: USDI Members: USDI, EPA, USDA, DOC, AEC, FPC, NSF, OEP, Industry, Other

Strategies, and the Analysis of Consequences. These three study areas will be broken up into specific tasks. Task Groups representing particular areas of expertise and drawing from various agencies will be formed to carry out the work of the program. The Groups will be of interagency composition, including expertise from the State and local levels as well as the private sector. Group leaders, selected on the basis of agency expertise in each particular subject, will form a task coordination committee reporting to the Staff Coordinators.

"Specific tasks will be assigned to the individual Task Groups by the Program Management Team through the Staff Coordinators. One such Group may work on several different tasks that may form part of the programs of different Staff Coordinators.

"As an example, the group developing the regional profile on air quality may also continue to identify environmental constraints under the Staff Coordinator for Constraints and Alternative Strategies. The same group, or part of it, will also analyze alternatives and develop models. This will simplify feed-back between the various Coordinator areas. In addition, modeling expertise will be maintained with the Task Groups, providing coordination with the collection of basic data.

"Some tasks, particularly those developing regional profile data, may be assigned, fully or partially, to on-going State or Federal programs. As an example, one or more tasks, or a portion of several tasks, related to surface resources could be carried out by Agriculture's Surface Environment and Mining (SEAM) program, which would coordinate State, local, and Federal involvement through programs now in the planning stage. Leadership in other tasks or sub-tasks could be assigned to individuals or groups which now have key national roles, such as the collection and display of the geologic data base by the U.S. Geological Survey and the offices of various State geologists. As another example, on-going studies with EPA of national supply and demand of energy and clean fuels will likely provide information useful to specific tasks under Constraints and Strategies and under the Analysis of Alternatives.

"Maximum reference to and use of on-going programs should prevent duplication of effort and speed completion of key jobs. However, full involvement of public agencies, industry, and individuals knowledgeable about a subject will be necessary.

Reports and Scheduling

"A pattern of reports and scheduling is suggested by the schematic in Figure 13; the preliminary design phase would make dates and tasks more explicit. Consultation between the Program Management Team and the Program

Review Board will be frequent and informal. It may be useful to schedule periodic meetings with the Program Review Board for progress reports.

"The Advisory Groups should serve in effective review roles. Comments of participants can be incorporated directly in final papers, ensuring participation by all interested parties at the most opportune time.

"A specially selected group of Technical Advisers will be called upon as needed to review the efforts and products of the Work Groups. The Technical Advisers shall be designated by and shall report to the Program Management Team and to the Staff Coordinators as appropriate.

"In addition to periodic oral and written progress reports to the Program Review Board, the substance of the program's output will take the form of a series of staff papers, some of which will appear in both draft and final form. The series would include the program design, resource and use inventories, analytical model descriptions, studies of institutions, and interim results. A final report, as noted, would provide an overview and consolidation of efforts and results.

Personnel

"In many cases, resources can be made available by program redirection and personnel detail with little sacrifice in on-going programs.

"The Program Management Team and Staff Coordinators must devote full time to the NGPRP.

"It may be necessary to contract some of the modeling effort. Certain resource inventory work and impact studies may also require explicit funding. Expenditures for preparation and publication of maps and reports could be considerable. Details of requirements and potential sources of funds will be estimated as part of the preliminary design effort.

APPENDIX 2

REGION VIII RECOMMENDATIONS ON PUBLIC INVOLVEMENT AND PARTICIPATION IN THE NGPRP*

"The Program Management Team should decide soon, the policy on information dissemination and public involvement, especially on whether a coordinated effort by the Team, or separate Agency efforts should go into information distribution.

"We recommend the following actions:

"1. A series of public information broadcasts and newspaper articles, especially in the Great Plains Region, to formally introduce the NGPRP. A notice that the overall NGPRP outline is available for public comment and review should be included.

"2. In addition to the national environmental groups provided, we feel it is important that regional interest groups be identified and made aware of the study's imminence. Region VIII recommends that participating agencies contribute a list of potential groups that would be interested in the study, from which a master list could be made. We have included a list of regional environmental and other selected interest groups that should be contacted. The overall study outline, or a suitable description of the study criteria and goals should be sent to these groups. The groups should be able to reply as to a choice of participatory alternatives such as:

a. comment and review overall study,
b. comment and review on working drafts, and
c. comment and review on technical papers.

"They could then be included on an appropriate mailing list, or arrangements could be made to include them in the work process.

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* Submitted to Program Management Team by Region VIII, EPA.

"3. We feel that the public meeting process is a key element for this study's success. We would strongly recommend public meetings at a number of locations in the study area at the outset, perhaps timed with the release of the overall study outline, to present for public information, the broad objectives and approaches of the study. The Program Management or even Program Review Board should perform this activity.

"We also feel that the public will be interested in recommendations of this study, at task force as well as overall policy levels. Any one of these areas might require a public meeting, but at this point, it is difficult to predict which ones. We recommend that a policy be adopted to inform the public through the meetings, and perhaps in written form, of the initiation of various tasks of this program. Comments should be invited, and the public reaction would determine whether a hearing needed to be held.

APPENDIX 3

EPA'S STATUTORY RESPONSIBILITIES VIS-A-VIS THE NORTHERN GREAT PLAINS RESOURCE PROGRAM

"This Accomplishment Plan has been prepared to detail the activities that EPA must take in the discharge of its statutory authority. There follows a summary of selected sections of EPA's statutes that direct the involvement detailed previously. Note that the directives of the Federal Water Pollution Control Act cover far more items than just water if those items can or do cause water pollution.

FEDERAL WATER POLLUTION CONTROL ACT, AS AMENDED, 1972

Section 102(a): "... in cooperation with other Federal agencies, State water pollution control agencies, and the municipalities and industries involved, prepare or develop comprehensive programs for preventing, reducing, or eliminating the pollution of the navigable waters and ground waters and improving the sanitary condition of surface and underground waters."

Excerpts: "... improvements necessary to conserve such waters ....
"... authorized to make joint investigations ...."

Section 103(a): "... shall encourage cooperative activities by States for the prevention, reduction, and elimination of pollution, encourage the enactment of improved and, so far as practicable, uniform State laws relating to the prevention, reduction, and elimination of pollution; ...."

Section 104(a): "... shall establish national programs for the prevention, reduction, and elimination of pollution and as part of such programs shall -

(1) "... in cooperation with other Federal, State, and local agencies, conduct and promote the coordination and acceleration of, research, investigations, experiments, training,

demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of pollution;

(2) "... encourage, cooperate with, and render technical services to pollution control agencies and other appropriate public or private agencies, institutions, and organizations, individuals, including the general public, ...

(5) "... (in cooperation) establish, equip, and maintain a water quality surveillance system (utilizing all resources available) ....

(b): (3) "make grants ....

(4) "contract with public or private agencies, ...

(6) "collect and disseminate, in cooperation with Federal departments and agencies, and with other public or private agencies, institutions, and organizations having related responsibilities, basic data on chemical, physical, and biological effects of varying water quality and other information pertaining to pollution and prevention, reduction, and elimination of pollution.

(7) "develop effective and practical processes, methods, and prototype devices for the prevention, reduction, and elimination of pollution.

* * *

(d): (2) "Improved methods and procedures to identify and measure the effects of pollutants, including those pollutants created by new technological developments ....

* * *

(t): "... (in cooperation) conduct continuing comprehensive studies of the effects and methods of control of thermal discharges ....

Section 105(d): "... an accelerated effort to develop, refine, and achieve practical application of:

(1) "waste management methods applicable to point and non-point sources of pollutants, ...

(3) "improved methods and procedures to identify and measure the effects of pollutants on the chemical, physical, and biological integrity of water, including those pollutants created by new technological developments.

Section 107(a): "... projects to demonstrate comprehensive approaches to the elimination or control of acid or other mine water pollution ....

Section 201(e): "... encourage waste treatment management which results in integrating facilities for sewage treatment and recycling with facilities to treat, dispose of, or utilize other industrial and municipal wastes ....

(f): "... encourage waste treatment management which combines 'open space' and recreational considerations ....

Section 301(a): "Except as in compliance with this section and sections 302, 306, 307, 318, 402, and 404 of this Act, the discharge of any pollutant by any person shall be unlawful.

Section 303(a): (1)(B) "Each State shall identify those waters or parts thereof within its boundaries for which controls on thermal discharges under section 301 are not stringent enough to assure protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife.

(b): "... estimate ... total maximum daily thermal level ....

Section 304(a): (1) "... (publish and periodically revise) criteria for water quality accurately reflecting the latest scientific knowledge (A) on the kind and extent of all identifiable effects on health and welfare ... (C) on the effects of pollutants on biological community diversity, productivity, and stability ....

(2) "... information (A) on the factors necessary to restore and maintain the chemical, physical, and biological integrity of all navigable waters, ground waters ... (B) on the factors necessary for the protection and propagation of shellfish, fish, and wildlife ....

* * *

(e): (2) (B) "mining activities, including runoff and siltation ... (F) changes in the movement, flow, or circulation of any navigable waters or ground waters ....

Section 306(b): (1) (A) "... steam electric power plants ... (B) ... Federal standards of performance ...."

Section 316: (Thermal Discharges)

Section 402: (National Pollutant Discharge Elimination System)

CLEAN AIR ACT, 1970

Section 101: "Federal financial assistance and leadership is essential for the development of cooperative Federal, State, regional, and local programs to prevent and control air pollution.

Section 102(a): "The Administrator shall cooperate with and encourage cooperative activities by all Federal departments and agencies having functions relating to the prevention and control of air pollution ....

Section 103(a): "The Administrator shall establish a national research and development program ... part of such program shall ...conduct and promote the coordination and acceleration of, research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention and control of air pollution ... conduct investigations and research and make surveys concerning any specific problem of air pollution in cooperation with any air pollution control agency with a view to recommending a solution to such problem ....

(b): "In carrying out the provisions of 103(a) the Administrator is authorized to: ... cooperate with other Federal departments and agencies, with other public and private agencies, institutions, and organizations, and with any industries involved, in the preparation and conduct of such research and other activities ... develop effective and practical ... methods ... for prevention or control of air pollution.

(c): "... conduct research on, and survey the results of other scientific studies on the harmful effects on the health and welfare of persons ....

* * *

(f): "... special emphasis to research on the short and long-term effects of air pollutants on public health and welfare ... may conduct epidemiological studies ... conduct ... studies on the immunologic, biochemical, physiological, and the toxicological effects ... consult with other appropriate Federal agencies to assure that research or studies ... will be coordinated ....

Section 104(a): "The Administrator shall give special emphasis to research and development into new and improved methods ... for prevention and control of air pollution resulting from the combustion of fuels.

Section 108(a): "... The Administrator shall issue air quality criteria for an air pollutant ... criteria ... shall include information ... on those variable factors (including atmospheric conditions) which ... may alter the effects on public health or welfare of such air pollutant ... types of air pollutant which ... may interact ... to produce an adverse effect on public health or welfare ... any known or anticipated adverse effects on welfare.

Section 114(a): "For the purpose of (i) developing or assisting in the development of any implementation plan under sections 110 or 111(d) ... The Administrator may require ... records ... reports ... monitoring ... and sample any emissions which the owner or operator ... is required to sample ...."

NATIONAL ENVIRONMENTAL POLICY ACT

Section 2: "... to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man ....

Section 101(a): "The Congress ... declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

Section 101(b): "... it is the continuing responsibility of the Federal Government to use all practical means ... to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may ...

(2) "assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;

(3) "attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;

(4) "preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;

(5) "achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities ....

Section 102: "... all agencies of the Federal Government shall

(A) "utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and decision making which may have impact on man's environment;

(B) "identify and develop methods and procedures ... which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations;

(D) "study, develop and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources ....

(F) "make available to States, counties, municipalities, institutions, and individuals, advice and information useful in restoring, maintaining, and enhancing the quality of the environment;

(G) "initiate and utilize ecological information in the planning and development of resource-oriented projects; ...."

APPENDIX 4

Northern Great Plains Resources Program
"Longer Term Study and Data Needs"

Submitted by Region VIII,
EPA, March, 1974

1. Surface water quality and hydrologic (flow, cross sections) network. Water quality data have not been collected to any degree which allows either accurate characterization of ambient quality or prediction of changes in quality as a result of changed use of water. Data deficiencies are attributable to (1) short periods of record, (2) sparse distribution of stations, and (3) limited chemical, biological, or physical measurements of presently occupied stations. The USDI-Geological Survey and EPA have initiated a somewhat more extensive surface water quality network in the States of Wyoming, North Dakota, and Montana as of the Spring of 1974. However, the sampling frequencies and 1-year period of record are insufficient to serve as a basis from which predictions can be made since the vagarities in flow from one year to the next may not be represented in the one year of data. Further, the ongoing analyses will be reconnaissance in nature due to the lack of information available on the importance of trace elements. With this and other ongoing research, the most important trace elements may not be identified until we are well into the surface water sampling operation and adequate baseline data for as yet unmeasured parameters would have to be acquired in subsequent sampling.

The gathering of background data cannot continue forever both because of ensuing development and because of a need to avoid studies with indefinite time frames. However, it will be necessary to develop monitoring networks for surface water quality that adequately measure impacts of man's activities. Thus there is an additional need to design sampling and assay networks that will allow planning and regulatory agencies to detect changes in water quality that may, in turn, affect the aquatic ecosystem.

At a minimum and based on our present knowledge of the importance of water quality parameters, measurements should include daily flow, daily temperature, daily conductance (with reliable conversion factor to total dissolved solids), daily to composited weekly pH, weekly dissolved oxygen with intensive surveys of hourly and daily DO during critical periods, weekly to composite bi-weekly assay of common ions (Ca, Mg, Na, etc.), weekly BOD (or COD or TOC providing interrelationship is determined) with intensive surveys of mixing zones in areas of BOD loadings, bi-weekly to composite monthly assay for "metals" (lead, copper, mercury, aluminum, boron, zinc, selenium, molybdenum, uranium, arsenic, etc.) and for fluorine, ammonia, nitrate-nitrite, and phosphorous with intensive surveys of daily concentrations in selected areas. Ideally, the network will be adapted to measure a minimum number of parameters whose selection will be based upon ongoing (present) efforts and new developments that may indicate which variables are most likely to be affected by coal or other resource "development".

2. Identification and quantification of source-terms for water quality predictions related to coal "development". There are no reliable or documented estimates of what changes in water quality parameters may occur if new coal-fired energy conversion facilities are installed in the Northern Great Plains. The inability to estimate changes in water quality is not only a function of the lack of ambient surface water and ground water quality data but also of the lack of definition of the amount and quality of water discharges from somewhat unique conversion processes such as coal gasification. Further, we lack information regarding the sediment yield from mined areas at various stages of development. As a result, it is difficult to predict changes in total dissolved solids concentrations and/or total suspended solids resulting from discharges.

While this need is a part of a complex situation which includes the need to accurately identify the quality of water conveyed to the conversion facilities, types of conversion processes, including cooling, and true water needs, disposal techniques, and shallow hydrologic regimes, the specific need herein described is to quantify water uses and discharges with measurement of any changes in water quality in operations such as mines, urban centers, or gasification plants. EPA has initiated an evaluation of water uses, needs, and economics through its Corvallis National Environmental Research Center. However, the effort is not yet extensive enough to cover coal strip mines and/or coal gasification plants with any high degree of certainty. The question of the impact on water quality of urban non-point sources is also not adequately addressed as yet.

3. Water use requirements and alternatives for coal "development". It appears appropriate for planners and regulatory agencies to know, with relative certainty, water use requirements are for various stages of coal development including mining, coal-fired power plants, coal gasification plants, in-situ conversion processes, urban centers, land rehabilitation, etc. This relates to the aforementioned need to quantify source terms for water quality predictions. However, it relates to all operations related to coal development rather than just those for which there is little knowledge regarding changes in water quality. For example, there is no basis upon which anyone can specify the minimum amount of water necessary to operate a 1000 Megawatt coal-fired plant or a 250×10^6 SCF/D coal gasification plant. Assessments of what improvements in technology might lower the present requirements are only started. The objective of fulfilling the need is to develop a methodology that allows the decision-makers to compare water use alternatives for proposed plants and to include in the comparisons economic tradeoffs.

4. Development of modelling tools that allow prediction of changes in aquatic ecosystem with emphasis on surface water quality. Water quality modelling has not been attempted in a comprehensive fashion for the areas such as the Northern Great Plains where data describing ambient quality and interrelationships between quality, flow and water uses are scarce. Existing modelling or predictive methodologies must be evaluated and modified if appropriate. New nethodologies may have to be devised. The outcome is to be the designation of the best model(s) with subsequent field verification

and collection of pertinent input data. The analysis will result in a method manual which described in detail the models available, the limitations and advantages, the sensitivities of the appropriate models to changes in key parameters and to data deficiencies. From this information, the monitoring network referred to above in Need #1 can be refined.

5. Continuation of the development of instream needs methodology and implementation of verified methodologies. EPA has funded an effort to review and refine the most appropriate measure of the affect of "artificial" (changed) stream flows on the aquatic ecosystem. EPA has also submitted for approval a contract that will further this effort to the field testing and verification stages. Questions to be answered involve evaluating the relative impacts of changes in streamflow caused by impoundments and diversions, and, possibly, discharges on the aquatic ecosystem which consists primarily of aquatic life such as fish and their food chain, aquatic vegetation including stream bank vegetation, and wild fowl dependent upon the flowing streams.

A methodology that adequately addresses both the macroscopic and microscopic levels of the ecosystem is required.

Upon successful development of the methodology for most streams, a scheme for collection of data and for monitoring impacts is required.

6. Assessment of shallow and deep ground water reserves and the impact of coal and related "development" on these resources. There are a number of areas under the subject of ground water that require additional efforts. To date the NGPRP has initiated a reconnaissance effort to enable predictions of the impact of strip mining on the physical and chemical characteristics of the shallow ground water regime. This effort is necessarily site-specific and limited. A comprehensive analysis of the shallow ground water system to enable predictions of potential impacts on the quality and quantity of these waters should be initiated. Leaching studies of spoils materials are appropriate along with microscale investigations of changes in water characteristics with time in the spoil materials of mines.

Deeper ground water resources have been reviewed in only a reconnaissance manner. Drilling programs have not been started. In order to assess the potential for developing (which assumes the simultaneous evaluation of the impacts of developing) deep (Madison) ground water, numerous measurements of aquifer characteristics and water quality are required. Sufficient bases to allow accurate planning of ground water withdrawals are necessary to avoid undue depletions of the ground water reserves.

Shallow aquifer data are needed to permit evaluation of the impact of large (new) reservoirs, primarily those used to cool or evaporate water discharges. For this purpose and others, the data needs include extensive aquifer testing to enable prediction of the reaction of the hydrologic system to new stresses.

7. Fate of trace elements in coal-fired energy conversion plants. EPA will be supporting a reconnaissance effort to determine the fate of trace elements contained in coal as the coal is burned and emissions formed in coal-fired power plants. It is hoped that three plants will be addressed. The objective is to quantify these fates so as to better identify what, if any, materials that are potentially hazardous may be emitted. Based then on these results, environmental sampling and assay schemes will be devised or modified to follow these critical trace elements.

It must be recognized that this effort, which in itself is a future need, will give data representative of only one point in time. Based upon this reconnaissance effort, one will be better able to assess the need for repetitive sampling at plants to arrive at average, maximum, and minimum concentrations in effluents.

The subject of trace elements also involves other areas in which additional work is required. Under needs described earlier for surface and ground water measurements, trace element content was discussed. The content of these elements on the terrestrial environment -- primarily in vegetation and animals. Also germaine is the adapation and testing of atmospheric diffusion modelling for discharges of trace elements.

The ongoing efforts have not, at this point, addressed the fate of trace elements in coal gasification plants. Since such plants are under serious consideration for the Northern Great Plains, it makes sense to evaluate these plants in the very near future.

The results of these measurements, when combined with studies of the secondary effects of emissions on the environment, will be useful in developing adequate emission control technology.

8. Alternative siting of energy conversion plants at greater distances from coal but closer to large waterbodies. This is a question in need of an answer that in turn requires more investigation. It is also a part of a larger question that will be addressed next. In general, three methods of energy production from coal have been seriously considered in the Northern Great Plains. Two methods involve coal-fired power plants, the third involves coal gasification. Siting of such plants has followed two lines of thought -- one suggests mine-mouth power plants and coal gasification plants, the other involves transportation of the coal to power plants near electrical demand centers. In both cases, water is generally transported to the plants unless the load center lies conveniently near a water supply. The question of interest then is, "is there a 'half-way point' where coal is transported to a site near large surface water bodies such as the Missouri River and electricity is then transported some distance to demand centers". The need obviously includes a need to assess the physical and ecological impact of the large discharges of heat into such water bodies as well as the efficiencies of such transportation.

9. Efficiencies of energy conversion and transportation. It would seem appropriate for the decision-makers to be able to make reasonable comparison between, for example, transportation of coal and transportation of electricity. A frequently-mentioned choice is that of mine-mouth power plant versus railroads to export coal from the region. This choice should have the benefit of quantitative analyses of coal transport economics, secondary fuel useage, status of more efficient means of transmitting electricity, in addition to impacts covered by other research needs or ongoing investigatory efforts. Choices between production of electricity versus gas should also have the benefit of economic and efficiency analyses.

Agencies such as the Federal Power Commission have supported efforts in these areas but the Northern Great Plains Resources Program has not reviewed nor utilized nor evaluated any ongoing efforts or planned efforts in this area of conversion efficiencies or transmission (transport) needs. Availability or feasibility of new technologies need to be publicized.

These considerations of the efficiency of conversion and distribution of energy are basic to siting and planning decisions required to guide coal "development" in the Northern Great Plains.

10. Social and economic description of present inhabitants of the Northern Great Plains. The short time alloted to Northern Great Plains Resources Program to date has not allowed a thorough description of the Northern Great Plains in terms of source of income, capital investments, taxes and expenditures. While EPA may be supporting efforts in future years, these efforts will be limited in nature. Extensive research through the records of various levels of government and interviews with representatives of the inhabitants will be required.

It would be hoped that this research need would also be extended to develop a methodology that might adequately identify and articulate the desires of the inhabitants insofar as coal development is concerned.

11. Demonstration of rehabilitation of strip mined areas in the Northern Great Plains. Rehabilitation of lands disturbed by strip mining activities in the Northern Great Plains Resource area has not been adequately achieved over large acreages.[1] The majority of rehabilitation that has been attempted has met with little success in stabilizing areas, providing a base for some land use, or improving aesthetics characteristics of the disturbed area. Failure or limited success of rehabilitation efforts thus far is a result of several factors and considerations. Lease stipulations and state reclamation law have failed to adequately define or require realistic and adequate rehabilitation procedures and objectives. Past and on-going research has been fragmented into several geographical areas with little

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[1] It is recognized that varying degrees of reclamation success have been achieved at a limited number of sites. One in North Dakota appears to be an excellent example of at least short-term success. Of course the annual precipitation is higher at this site.

technology transfer from one area to another. Research efforts that have been demonstrated as having high potential for successful rehabilitation have not been demonstrated on areas large enough to resemble future needs for the large land areas that may be disturbed in the future.

The objectives of a large area demonstration would be (1) to develop adequate rehabilitation stipulations for use in leasing permits and as a basis for legislative requirements, (2) to combine the various results of research efforts, both past and on-going, into a viable and realistic approach to rehabilitation, (3) to demonstrate the technology and methodology of rehabilitation to allow industry to determine costs and equipment requirements necessary to carry out the job, (4) to determine and evaluate long term trends and effects of rehabilitation, (5) to determine if the best present methods of rehabilitation are adequate and to identify possible weaknesses or shortcomings needing further research, and (6) to prepare examples of reclamation costs.

The objectives outlined are comprehensive and far-reaching. To achieve these objectives a very comprehensive program will be required. The duration of the demonstration should be a minimum of 10 years with on-going observations from time to time thereafter. Remote sensing techniques will be evaluated as an observation tool. Other areas to be assessed are (1) relationships of vegetation to groundwater aquifers, (2) fertilizer effects on water quality and (3) development of seed sources for natural vegetation.

12. Adequacy of laws and regulations to properly review, approve, plan for, monitor, and terminate the various activities possible in the course of coal "development". The Northern Great Plains Resources Program has very adequately presented so-called "constraints reports" from the various work group efforts. However, time has not permitted an assessment of the existing laws, regulations, and regulatory staffs as to their capabilities of coping with coal "development". It would seem that comprehensive lists of lease stipulations and required data are needed to allow proper control of development. It is also possible that significant increases in staffing are necessary for proper control. An objective would be the preparation of model legislation.

13. A thorough assessment of the Northern Great Plains Resources Program as a comprehensive fact-finding, analytical, and informational effort that could serve as a guide to assisting with the evaluation of similar resource "development" opportunities. The Northern Great Plains Resources Program may be viewed as the second attempt to plan, evaluate, and prepare for large-scale development of energy fuel reserves located in a relatively small geographical area. The first was the Southwest Energy Study and addressed itself to the development of coal in the Four Corners area of the Southwest United States. The NGPRP was next and was designed to provide an "analytical and informational frame work for policy and planning decisions at all levels of government" in relationship to development of coal and other resources in the Northern Great Plains (Montana, North Dakota, South Dakota, Wyoming). The NGPRP has been working for one and one-half years

of its projected three-year lifetime. Its future must be assessed in terms of its objectives and accomplishments. Now geographically-confined, rich, deposits of oil shale are being opened to prototype development. The most effective framework to plan and direct these developments must be established immediately. The proposed project will evaluate the NGPRP as an example of such a framework and recommend the most effective methodology to address oil shale and other Regional energy resources.

The assessment will address the mechanism, the timing, the participants (composition), the methodology, the success, and the future in terms of adequacy of data, Program continuance, transfer of responsibilities, and the appropriateness of a similar effort for oil shale and Energy Resource Development as a whole, the latter primarily in the West. The assessment will review the Program timing as it relates to resource development, leasing, technology development, and energy demands. Program success will be reviewed from the standpoint of producing regional profile data, providing support to planning and regulatory agencies, providing leadership and a focal point, directing related research and investigative efforts, and identifying future legislative, research, and monitoring needs. The assessment will treat the various alternatives for Program continuance, whether it be in the same format, abandoned, divided into ongoing coordination effort, or some combination.

The value of such an assessment lies in the information garnered to direct comprehensive efforts in evaluating oil shale and other large-scale energy (or human) resource "development".

14. Continued evaluations and new demonstrations of alternative cooling techniques for coal-fired plants. The need to quantify water requirements and evaluate reductions in water uses has been noted previously (#3). The alternatives of combination cooling (dry-wet) have been identified and accepted as applicable to the Northern Great Plains by some. There is a need to both demonstrate the efficiencies and monitor impacts of dry-wet cooling options.

15. Evaluation of the impact on water resources if a large scale shift from agrarian water use to industrial and domestic use occurs. This need phases with many earlier identified needs but it seems appropriate to reemphasize that little is known about the effects of present agricultural water use in the Northern Great Plains or about the effects of transferring water from agricultural to consumptive or non-consumptive industrial use.

16. Effects of impoundments along perennial streams on water quality and the aquatic ecosystem. Little is known about the actual effects of such impoundments since there are few within the Northern Great Plains and none that have been monitored. Potential impacts on fisheries and water quality have been identified but not measured or verified in the field. Some field investigations of existing natural and man-made impoundments will add significantly to the predictive capabilities.

17. Development of remote sensing (aerial imagery) as an inventory and enforcement tool. EPA is supporting the continuing effort to inventory strip mined areas. More specifically, the areas of interest are:

1. Inventory of active and "abandoned" coal strip mines in the Northern Great Plains. Evaluate natural terrain and geomorphological features, provide quantitative summary of disturbed lands, and provide quantitative evaluation of reclaimed lands. Species groupings, drainage patterns, aesthetics, and subsurface hydrology are of concern. In most cases the subsequent use of the mined land could either be for grazing or scenic (wildlife, view) use.

2. Evaluate the use of remote sensing (imagery) for purposes of land use planning associated with coal development in the Northern Great Plains (planning for coal mining, urbanization, power plants, etc.) by State and local entities. Determine usefulness, optimum techology, and methods of interpretation.

3. Evaluate the use of aerial photography and photogrammetric methods to plan the recontouring of disturbed areas to "approximate original contour". Such methods, if feasible, to be available to State and local entities and industry. Possible computer analysis to derive statistical description of terrain which is then converted to earth-moving instructions for the rehabilitation process.

4. Evaluate the use of remote sensing (aerial) to monitor rehabilitated areas and to monitor conformance with State, local and Federal regulations. Identification of viability of species, quantitative progress of rehabilitation, problem areas (vegetative stress, erosion), and invasion of native species.

18. Evaluate the use of imagery and remote sensing for purposes of energy-conversion plant siting in terms of meteorological variables. Also evaluate in terms of impact of emissions from existing energy-conversion plants on vegetation. Results from fluoride-contaminated areas indicate the potential for some success with such methods.

19. Analysis of the effects of airborne emissions from coal-fired plants on soils and vegetation in terms of trace elements and more common pollutants. This is essentially the study of "secondary effects" of pollutants on other than those effects directly affecting human health. These effects are the complex changes in ecosystem dynamics that may result from the stresses of pollution or harmful elements as opposed to the "simple" or direct affects of air pollutants previously reported in the literature. Response mechanisms may result in reversals of successions or in simplifications of the ecosystem structure, in reductions in the ratio of photosynthesis to respiration, or in reductions in the nutrient inventory. Effects may be temporary and reversible or may be chronic and cumulative. To be studied are food chains and mass and energy flow patterns. Laboratory, field plots, and in-situ work is appropriate. Include effects on new vegetation.

It will be necessary to determine and refine the state-of-the-art in sampling for trace elements in soils, animals, and vegetation.

20. Identification of trace element content of coals and correlation with stratigraphy and lithology. This correlation will assist in planning the mining of coals if it allows identification of high concentrations of potentially hazardous trace elements.

21. Experimentation and evaluation of computerized plotting routines that facilitate the planning of plant siting (mine mouth) and land rehabilitation (after strip mining). It appears feasible to utilize graphical methods to plan rehabilitation of lands that may be mined. Such rehabilitation would include not only reconturing to minimize erosion and to maximize vegetative growth but also rehabilitation that adequately provided for large scale drainage and appropriate post-mining land use.

22. Detailed on-site characterization of ecosystems in the areas of potential mining. The objective is to identify fundamental interactions among various biological and physical components of the ecosystems. The Surface Resources Work Grouphas not had the opportunity to perform the field work necessary to both develop the best methodology or to collect information.

23. Detailed soils surveys of potential development sites. Such surveys would describe in great detail (in excess of that utilized for the Crow Reservation) those soil characteristics that both determinedthe vegetative ecosystem including the potential for disturbed soils to support new vegetation and for how long, and the animal ecosystems extant.

24. Leaching tests of soils and spoils materials laying in proximity to coals. The potential impacts of leaching on ground water quality are addressed in an earlier Need. The leaching tests of spoils samples are required to better estimate the potential of spoils to contaminate ground water and to develop appropriate field tests as well as laboratory tests that allow the planner, through mediums including the mining plan, to avoid highly detrimental overburden. If appropriate, such testsmay lead to identification and testing of methods to limit leaching of potentially harmful elements. EPA is planning to support a reconnaissance effort in this area during 1974.

25. Identification of correlations between trace element content of surface and near-surface waters, parent material, soils, and sediment. For purposes of land use planning as well as for identifying and understanding ambient levels of selected trace elements such as mercury, selenium, molybdenum and arsenic, it is necessary to establish relationships between the concentrations of these elements in these various mediums and weathering/transport mechanisms. The value lies not only in the increased understanding of "background" concentrations vis-a-vis increased concentrations caused by coal "development" but also in the identification of situations where improper land use would cause high concentrations of hazardous elements. EPA is planning to fund a reconnaissance effort in South Dakota in 1974 that approximates the initial phases of this need.

26. Identification of vegetative and micro-animal succession in rehabilitated areas. This is related to earlier described needs, however, the problem is of sufficient impact to warrant separate and simultaneous study. The question involves the quantification of invading species and the viability of these species. Obviously the question entertains answers to the length of time required for viable vegetation to be established to the same degree of permanence enjoyed by vegetation extant before disturbance.

27. Is the waste heat produced by coal fired plants a potential year-around source for warm water fisheries? Franklin Institute has planned to test the theory in the East. A feasibility study of literature and experiments seems appropriate for the Northern Great Plains.

28. Determination of the feasibility and, if appropriate, demonstration of advanced longwall mining techniques in western coals. This need has been expressed to members of the Mineral Resources Work Group. Methods of "longwalling" shallow, thick coals have been developed in Europe. Shallow longwall mining of a relative thin coal seam is underway in West Virginia. Questions of equipment requirements, efficiency, and surface impacts of identical mining of thicker, shallower, and, perhaps, younger coal seams in the West have yet to be answered. The Bureau of Mines is considering a feasibility-demonstration of advanced longwalling in the West.

29. Increased and comprehensive investigations into the feasibility of in-situ conversion of coal to gas and liquids. The single Bureau of Mines experiment in Wyoming has not provided an in-depth investigation of the pros and cons of in-situ production from coal. Due to the potential for both extraction with less surface disturbance (assuming no subsidence) and for a relatively (to stripping) low recovery efficiency, increased investigation is most desirable.

30. Compilation of water rights, uses, and efficiencies of use. To date, water rights, as awarded or claimed under western water low, have not been addressed by the Northern Great Plains Resources Program. The present uses of and legal rights to water should play a large role in planning for coal development.

31. A thorough assessment of coal reserves in the Northern Great Plains. The lack of ability to estimate the coal reserves beneath those 1.3+ million acres of land already leased in the Northern Great Plains indicates the lack of knowledge as to how much coal lies where. Since without these data it is unlikely that decision-makers can identify better (versus worse) courses of action regarding coal development, an intensive effort to garner coal resource data should be mounted immediately.

32. Completion of topographic mapping in Northern Great Plains should be a high priority item.

33. Development of refined, updated, and streamlined models for predicting or developing energy demand-supply curves. The Northern Great Plains

Resources Program has utilized a projection of energy demand based upon assumptions that are neither clearly understood nor agreed with. It would appear that the decision-makers require better and clearer projections of realistic energy demands. Such demands should be projected objectively by agencies with no particular prejudice.

34. A more comprehensive evaluation of resources development in the Northern Great Plains. The need exists to broaden the Program to include all energy fuels or sources that exist in the region plus those that could affect the same region in terms of population increases or transportation. Resources include uranium, oil, gas oil shale, hydroelectric power, recreation, solar energy, wind energy, increased agriculture, or other industry. While there are recognized limitations to such an evaluation, it is imperative that certain of the aforementioned resources are included in the quantification and evaluation of coal "development".

35. Analysis of impacts of transbasin diversions (including coal slurry pipelines) on quality of water and environmental effects in areas of water origin, including the Colorado River Basin. To date, the Northern Great Plains Resources Program has not treated transbasin diversions seriously.

36. Siting Conference. The Program should serve as the sponsor for an informational, technical, and public conference covering the complex subject of coal-fired, steam/electric generating plant siting as well as energy conversion alternatives to CFPP's (coal fired power plants). The Conference would be major, similar in size and scope to annual meetings of multi-disciplinary groups such as the American Association for the Advancement of Science (AAAS). A four-day schedule of simultaneous meetings and an additional day of field trips is envisioned. EPA has previously prepared an outline for such a conference in the Regional "Accomplishment Plan" (Jul 73).

37. Survey, identify, and evaluate unique geologic, archeologic, historic, wildlife, and other ecologically-recreationally-, and aesthetically-valuable resources of the region. Identify areas and situations where strip mining, coal conversion, energy transport systems, etc. will threaten resources. Recommend measures to protect or otherwise preserve appropriate resource values.

38. Fugitive dust. The disturbance of land as a result of mining and related activities will cause an increase in the emissions of fugitive dust. In order to assess impact of these emissions on air quality, a study on a specific area will be designed. The background level should be assessed in an area prior to the start of a mining operation.

An air monitoring network will be designed using hi-volume samples to assess particulate concentrations. The network will be developed to assess impact in the immediate vicinity of the mining operation and at several sites at varying distances from the operation.

In addition to assessing the impact in terms of mass per volume for particulates, the filters will be analyzed for trace elements. This will be accomplished by using a combination of quantative and qualitative procedures for measuring trace elements.

A study of trace element content in surrounding vegetative growth will be conducted in conjunction with the particulate air monitoring efforts.

39. A coordinated study will be conducted in the vicinity of a major coal fired power generating plant to assess the impact of emissions. The study will include an air quality monitoring network, a mass chemical analyses, and an evaluation of the concentrations in soils, plants and animals.

The air quality monitoring network will sample the particulate and certain gaseous concentrations. Gases considered will include the criteria pollutants and other gases of general concern. The filters used to collect particulates will also be used to assess certain trace elements.

The concentration of trace elements in the soil, plants and animals will be correlated with the emissions coming from the plants. It is recommended that a cooperative arrangement be made with the State Game Commission for the animal studies. The study dealing with soils and plants could be coordinated with EPA research laboratories.

Special attention will be given to the effect of sulfur oxide emissions on plants, especially on land areas in the process of being reclaimed.

40. Regional diffusion models. The availability of a model to predict regional air quality and long distance transport of pollutants is very desirable. A case by case investigation of single emission sources will overlook the cumulative and interactive impacts of many sources within a region. Consequently, we identify the need for the adaptation of an existing regional transport and diffusion model for use in the Northern Great Plains Region. This model should:

1. Be capable of being understood by decision-makers without technical expertise.

2. Have been tested with some verification data available.

3. Use readily available air quality and meteorological data.

4. Provide output which can be easily compared to air quality standards.

An additional longer term need is for the development of new, more refined regional air quality models which remove some of the simplifying assumptions of existing models. Some Site Specific Verification is required.

41. Trace element source sampling. There is a need to identify the type and quantity of trace element emissions from coal gasification plants so that we may predict the atmospheric loadings and effects resulting from these plants. Bench scale and pilot plant studies are being performed on a couple processes in this country, but there is no work published on commercial plants, since the U. S. does not have any commercial sized plants. There is a need to study the European and/or African gasification plants. Research funds may be funneled through AGA or other avenues to perform source sampling programs on those plants. The NERC-RTP via CSL may be the vehicle for promoting these studies because of their substantial budget. However, Region VIII should have input to this activity in the form of suggestions to the type of work performed.

Also, a literature survey of the type of data available regarding these gasification plants should be performed.

A concern over the concentrations of trace elements in the respirable size range of particulate matter is evident. The program carried out with FY 74 monies through Region VIII will not be able to identify or characterize these data. An intensive sampling program should be performed on a single coal-fired plant to provide insight to this concern. This type of work would be an expansion to the work that has been performed by the NERC-RTP upon a few (about 10) trace elements.

The AEC (Livermore Lab) is interested in participating in this type of program. It is conceivable that an interagency agreement could be entered into in order to conduct an extensive program.

42. Visibility assessment. The need for the development of methodologies to assess visibility and other impacts of increased sub-micron particulate loadings upon the atmosphere is required.

All available existing visibility data in the Northern Great Plains Region needs to be compiled. Airports and local observers are two possible sources.

Within the next year, an attempt at formulating a visibility assessment methodology is needed. Furthermore, it must be implemented at least at one site in the Northern Great Plains, for example Colstrip or Gillette. Data collection should occur before and after large power plants begin operation to assess the effects that increased particulate emissions have on visibility. Sampling ambient air for particulate particle size will accompany in-field visibility assessment.

43. Oxidant potential from coal gasification. The large scale development of fuel conversion facilities in Region VIII will bring with it the large increase of emissions. Substantial HC and NO_x emissions will occur. This situation plus the high frequency of sunlight in the NGP provides the excellent potential for photochemical oxidant formation. Also, it is suggested that presently the oxident air quality standards are being

exceeded in many non-urban locations. In order to assess the impact of the proposed development, it will be necessary to locate some HC and oxidant air quality monitors in the region. This effort may be a part of the present NGP monitoring network and tied into the present contractural arrangement.

44. Coal gasification emissions. Little or no firm knowledge exists regarding the quantity of criteria pollutant emissions from gasification plants. Also, of significant interest are the magnitude and type of reduced sulfur compound emissions from these plants. The NERC-RTP is working on the development of emissions estimates and NSPS for gasification plants at the present time. It would be helpful for them to have actual emissions data from the commercial plants overseas. Region VIII input to this aspect of work will consist of keeping in close contact with what RTP is doing and making suggestions on the scope of work being followed.

Adequacy and extent of control technology for the present commercial plants is unknown. Region VIII will perform a literature search after consulting with RTP in an attempt to answer this question. It is not anticipated that any contractual work will be required.

45. Determination of the effect increase in cloud condensation nuclei might have upon amount of rainfall. Several research studies have produced statistical support of both positive and negative effects of urban produced aerosols (e.g. from power plants) on precipitation. The difference in the conditions surrounding a positive effect as compared to a negative effect have not been conclusively determined. Many new power plants and gasification plants planned for the Northern Great Plains area will produce considerable air emissions, some of which will become cloud condensation nuclei. The effect of the addition of significant quantities of these nuclei on precipitation in this region must be investigated.

46. FGD* waste disposal. A requirement for wide scale FGD development is not anticipated in Region VIII unless State regulations (such as Colorado's) become more stringent than the NSPS, or if resolutions to significant deterioration mandate additional control. The amount of material to be disposed of is not as critical as the nature of the material. Collected flyash volume would be significantly greater than the anticipated SO_3 or SO_4 sludge. The chemical nature of the sludge could present a potential water problem.

Also, the capture and ultimate disposal of sludges containing possibly significant quantities of trace elements heretofore uncollected may require careful handling.

Utilization of sludge is being studied and should be followed and promoted.

Most of the work in this area will be in-house requiring manpower from Region VIII as well as RTP. Some contractual work is anticipated, possibly through expansion of ongoing work at RTP-CSL.

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* Flue Gas Desulfurization

47. Colstrip. An intensive study should be planned to source sample the Colstrip plant when it comes on line. Guidance from the FY 74 trace element sampling program will be utilized. An attendant intensive ambient monitoring program should be provided at the same time as the source sampling effort. This dual sampling effort should provide data with which to assess the adequacy of present diffusion models to predict trace element concentrations.

48. Effects of CO_2 and/or particulate. Scientific theories have been advanced which predict profound effects upon the weather and climatological status of the earth. Global measurements of CO_2 and particulates are being conducted. It is theorized on one hand that if CO_2 levels continue to increase as a result of combustion of fossil fuels, an increased trapping of infrared radiation will occur. This would result in a gradual heating effect and eventually cause the "greenhouse" effect. Increased CO_2 levels have been noted at the Mauna Loa observatory in Hawaii.

On the other hand, it has been suggested that if the atmosphere is subjected to increased particulate loadings, the amount of solar radiation reaching the ground will be reduced. This would result in an "ice age" effect.

A long term monitoring program would be necessary in order to make sound judgments on these two theories. At least 15 years of data would be needed to make any meaningful conclusions. CO_2 measurements could be made as a part of the NGP monitoring network.

49. Acid rain. In order to verify the effects of increased atmospheric SO_2 loadings upon the pH of rainfall, extensive rain data and analyses would need to be performed. The key factors determining the pH of rain should first be identified. The chemistry should be discussed. Region VIII could provide substantial input to this project. Also, a literature search regarding this subject especially looking at University thesis would provide some initial data.

Collection of rainwater along with routine analyses could be performed in conjunction with the NGP monitoring network.

50. SO_4 levels. Effects upon health, vegetation, and visibility by SO_4 are not well understood. It is theorized that some concentrations may prove harmful. Due to the increased fuel conversion facility development in the NGP, an increase in particulate matter and SO_2 will result. Thus, we have the makings for sulfate production. Measurement of the SO_4 concentrations on all hi-vol filters in the NGP monitoring network would provide the data necessary to make some comments upon the trend of SO_4 levels in the atmosphere. Also, it will provide an important function by comparing the data to existing State standards. A long term study is required (at least 10 years) in order to make meaningful conclusions.

51. Nitrate and flouride levels. Effects upon health, vegetation and visibility due to concentrations of nitrates and flourides are not well understood. Nitrate and flouride emissions in the Northern Great Plains will undoubtedly increase with the addition of new power and gasification plants. Therefore, it will be necessary to analyze the NGPRP high-volume sampler filters for nitrate and flouride concentrations as well as sulfate and trace elements. Trend analysis is desirable and requires long term sampling (at least ten years) in order to draw valid conclusions.

52. The interplay of the Northern Great Plains Resources Program and recently promulgated federal and state regulations needs to be studied in detail. In view of recent promulgation of air regulations, indirect source regulations, 10-year maintenance plans and the soon to be promulgated significant deterioration regulations, the problem of energy resource development compatibility with such regulations should be evaluated in a systematic way. This will require an assessment of air sheds in the area, establishing air quality zones, and redesigning, if necessary, an air quality monitoring network to ascertain if the standards are achieved.

The compatibility of the energy resource development scenarios from the NGPRP to pertinent standards will be evaluated by employing point source and regional diffusion models. This effort could provide considerable information to the States in terms of siting guidance.

53. The quantity of emissions emitted from an energy resource development area would indicate that health assessments should be scheduled both before and after the facility is operational.

A potential site would be the Crow or Northern Cheyenne Reservation in Montana. A number of samples should be installed on the reservation and allowed to operate for several years as development takes place. This would allow for documenting impacts on air quality and human health over time as mines, power plants and gasification facilities become operational. The Indian Health Service could cooperate with health related aspects of study.

A second potential study would be a CHESS type study in an intensive development area such as Stanton. Since development is just starting, the study could acquire baseline information, if started immediately, and then track related health effects, if any, as development proceeds.

This would be a long term study running perhaps 10 years.

54. Characterization of trace element and major element distribution in particulates to determine sources. The need is to relate various trace and major elements to sources, both natural and man-made, by electron microscopy and x-ray diffraction techniques which may be used to quantify the shapes and origins of particulates. The method has been used successfully in studies of Denver's air pollution. The objective includes determination of background distributions.

55. Inventory vegetation characteristics of strip mineable areas to determine rehabilitation potential of ecosystems. Synthesize part research data and field analyses to facilitate the characterization of vegetation groups that overlie strippable coal deposits. Formulate specifications for the best known means of rehabilitation that also safeguard against environmental degradation. Incorporate vegetative and animal sciences with landscape architecture and geomorphology.

56. Research into, development, and testing of methodologies necessary to organize related data generated as a part of or related to the activities of the Northern Great Plains Resources Program. This need is not yet well-defined but may be considered to include methodologies to relate and compare the total impacts of development alternatives where the impacts are diverse and difficult to quantify (e.g. environmental impact analyses). The need also includes the identification of those NGPRP data, if any, that may not be adequately available or stored as a part of some agency's function and which therefore should be stored for retrival using a new procedure, methodology, or format. Such data may be maps, numerical data, news releases, technical investigations, etc.

APPENDIX 5

Siting Conference

It has become increasingly apparent that the Northern Great Plains Resources Program should serve as a sponsor of an informational, technical, and public conference covering the complex subject of coal-fired, steam-powered, electric-generating plant siting as such siting pertains to the Northern Great Plains (Montana, North Dakota, South Dakota, and Wyoming). This subject has been treated in the resources allocation for all Task Groups or Subject Areas where EPA input from and EPA participation in the Conference would be expected. But, due to the all-encompassing nature of such a Conference, this separate section has been prepared to express our concern for interest in, and a tentative outline for this Conference.

We envision the Conference as a major one, similar to annual meetings of such national organizations as the American Geophysical Union, the Geological Society of America, the American Institute of Mining, Metallurgical and Petroleum Engineers, the American Association for the Advancement of Science, the American Institute of Electrical Engineers, etc. We propose a three or four day schedule of simultaneous sessions and at least one-day long field trip. The Conference would be comprised of major addresses, invited papers, and public discussions and forums. The Conference proceedings must be published.

We have considered cosponsors to include the States of Montana, North Dakota, South Dakota, and Wyoming; the Federal agencies contributing to the NGPRP; selected Universities; public groups such as the Sierra Club; private groups such as the Edison Electric Institute and the American Public Power Association; and one or more National Professional Organizations. The location of Billings, Montana for the Conference has been briefly discussed. Assuming that the Conference should be held at a time when travel is possible and when Universities are either open or during short vacation periods, we have tentatively scheduled the Conference for the early spring of 1975, though an earlier date, such as the fall of 1974, would be preferable.

A proposed outline for the Siting Conference is presented in Table H. The outline presents only the possible Session Headings and specific items that may be discussed. The outline does not attempt to schedule simultaneous sessions.

The objectives of this Siting Conference are as follows:

1. To gather technical data that identify the state-of-the-art insofar as control technology, energy conversion technology, mining technology, revegetation technology, predictive techniques, and monitoring are critical to the decision-making process that is to be supported by the NGPRP, and to allow the NGPRP to benefit from these data.

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2. To poll both the public sector and the technical sectors on their attitudes regarding resource development in the area of the NGPRP and to document these attitudes for the benefit of those who must make decisions regarding coal and other resources development.

3. To present the work of the NGPRP Staff as it exists to date.

4. To develop a power plant siting philosophy and criteria therefore which begins to identify the many options existing and methods to predict and evaluate the impacts, both direct and secondary impacts.

5. To define the options or decisions inherent in energy supply and demand projections and to evaluate such options and the means to both measure and improve predictions of energy demand.

6. To publish the papers presented and summaries of discussions held.

Table H - Northern Great Plains Resources Program - EPA, Region VIII Accomplishment Plan

Task: Siting Conference - Proposed Outline

I. General Session

  A. Keynote Address(es)

    Problems of states relating to coal development and power production.

    Problems of Regions relating to coal development and power production.

    Problems of Nation relating to coal development and power production.

  B. Northern Great Plains Resources Program (NGPRP)

    Objectives & Participants.

    Accomplishments to date.

    Future Actions.

  C. Purpose of Conference

II. Available Mineral and Surface Resources in NGPRP Area

  A. Energy Fuels - identify, quantify, and evaluate

  B. Other Mineral Resources - identify, quantify, and evaluate

  C. Surface Resources including scenic values, recreational values, fish & wildlife - identify, quantify, and evaluate

  D. Ecosystem - Type Evaluation of interactions between resources if selected developments occur

  E. Mining Methods

Table H (Continued)

- III. Atmospheric and Meteorological Aspects of Coal-fired Power Plant Siting
    - A. Present Air Quality - including visibility
    - B. Climatology and Meteorology - prevailing patterns and modeling
    - C. Emissions - including steam
        - 1. Health and legal consideration.
        - 2. Present and future quality and control technology.
        - 3. Other energy conversion processes and gaseous emissions.
        - 4. Monitoring and chemical analysis.
        - 5. Modeling.
        - 6. Secondary impacts.
    - D. Ongoing State, Federal and institutional activities
- IV. Subsurface and Surface Water Resources and Aspects of Power Plant Siting
    - A. Present water quality and quantity and use
    - B. Effluents
        - 1. Water use and options.
        - 2. Present and future quality and control technology.
        - 3. Other energy conversion processes and liquid effluents.
        - 4. Secondary impacts.
        - 5. Legal considerations and health implications.
    - C. Ongoing State, Federal and institutional activities

Table H (Continued)

V. Land-Use Considerations (See also II)
    1. Choices, legal constraints or guidelines, public desires.
    2. Restoration and rehabilitation of disturbed areas.
    3. Alternative methods of resources extraction.
    4. Future land uses.
VI. Socio-Economic Considerations
    1. Economics of region and solutions.
    2. Economics of coal developments - Mine-mouth plant vs. transport.
    3. Social and cultural impacts.
    4. Associated and secondary growth.
    5. Recreational values.
VII. Environmental Synergisms
    1. The integrated impact on people, wildlife, air, water, vegetation, etc.
    2. The National Environmental Policy Act.
    3. Methods of predicting and analyzing the integrated impact.
VIII. Public Forum
    Somewhat "Free-Form" series of written statements and formal discussions interspersed with informal work shops conducted by chain people and Recorders.
IX. Legal and Regulatory Constraints
    A power plant siting law.
    State laws and regulations - proposed and existing.

Table H (Continued)

X. Energy Production and Transmission Techniques and Potential
  - A. Geothermal
  - B. Nuclear
  - C. Gasification
  - D. MHD
  - E. Solar
  - F. Transmission
  - G. Water
  - H. Research needs

XI. Summary Session - Siting Criteria

What criteria, how evaluated, who regulates, economics, public involvement.

XII. Energy Demands and Supply
  - A. Regional
  - B. National
  - C. How shall the two coexist

XIII. Field Investigations

(Field trip(s))

APPENDIX 6

MONTANA STRIP MINING
AND RECLAMATION ACT

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CHAPTER NO. 325
MONTANA SESSION LAWS 1973
SENATE BILL NO. 94

AN ACT CREATING "THE MONTANA STRIP MINING AND RECLAMATION ACT" AND PROVIDING FOR THE CONTROL OF PROSPECTING FOR AND THE STRIP MINING OF COAL, CLAY, PHOSPHATE ROCK, AND URANIUM; PROVIDING FOR PERMITS, RECLAMATION PLAN REQUIREMENTS, METHODS OF OPERATION, AND PENALTIES; PROVIDING FOR THE TERMINATION OF RECLAMATION CONTRACTS ENTERED INTO UNDER CHAPTER 245, LAWS OF MONTANA, 1967; REPEALING SECTIONS 50-1018 THROUGH 50-1033, R.C.M. 1947; AND PROVIDING AN EFFECTIVE DATE.

BE IT ENACTED BY THE LEGISLATIVE ASSEMBLY OF THE STATE OF MONTANA:

Section 1. This act shall be known and may be cited as "The Montana Strip Mining and Reclamation Act."

Section 2. It being the declared policy of this state and its people

--to maintain and improve the state's clean and healthful environment for present and future generations,

--to protect its environmental life-support system from degradation,

--to prevent unreasonable degradation of its natural resources,

--to restore, enhance, and preserve its scenic, historic, archeologic, scientific, cultural, and recreational sites,

--to demand effective reclamation of all lands disturbed by the taking of natural resources, and

--to require the legislature to provide for proper administration and enforcement, create adequate remedies, and set effective requirements and standards (especially as to reclamation of disturbed lands) in order to achieve the aforementioned objectives,

the legislature hereby finds and declares:

(1) That, in order to achieve the aforementioned policy objectives, promote the health and welfare of the people, control erosion and pollution, protect domestic stock and wildlife,

preserve agricultural and recreational productivity, save cultural, historic, and aesthetic values, and assure a long-range dependable tax base, it is reasonably necessary to require, after the effective date of this act, that all strip mining operations be limited to those for which annual permits are granted, that no permit be issued until the operator presents a comprehensive plan for surface reclamation and restoration, together with an adequate performance bond, and the plan is approved, that certain other things must be done, that certain remedies are available, and that certain lands because of their unique or unusual characteristics may not be strip mined under any circumstances, all as more particularly appears in the remaining provisions of this act.

(2) That this act be deemed to be an exercise of the authority granted in the Montana constitution, as adopted June 6, 1972, and in particular, a response to the mandate expressed in article IX thereof, and also be deemed to be an exercise of the general police power to provide for the health and welfare of the people.

Section 3. Unless the context requires otherwise in this act:

(1) "mineral" means coal, clay, phosphate rock, and uranium;

(2) "overburden" means all of the earth and other materials which lie above a natural mineral deposit and also means such earth and other material after removal from their natural state in the process of strip mining;

(3) "strip mining" means any part of the process followed in the production of mineral by the open cut method including mining by the auger method or any similar method which penetrates a mineral deposit and removes mineral directly through a series of openings made by a machine which enters the deposit from a surface excavation, or any other mining method or process in which the strata or overburden is removed or displaced in order to recover the mineral;

(4) "prospecting" means the removal of overburden, core drilling, construction of roads or any other disturbance of the surface for the purpose of determining the location, quantity, or quality of a natural mineral deposit;

(5) "area of land affected" means the area of land from which overburden is to be or has been removed and upon which the overburden is to be or has been deposited and includes all lands affected by the construction of new railroad loops and roads or the improvement or use of existing railroad loops and roads to gain access and to haul the mineral;

(6) "operation" means all of the premises, facilities, railroad loops, roads, and equipment used in the process of producing and removing mineral from a designated strip mine area, or prospecting for the purpose of determining the location, quality, or quantity of a natural mineral deposit;

(7) "operator" means a person engaged in strip mining who removes or intends to remove more than ten thousand (10,000) cubic yards of mineral or overburden;

(8) "person" means a person, partnership, corporation, association, or other legal entity, or any political subdivision, or agency of the state;

(9) "method of operation" means the method or manner by which the cut or open pit is made, the overburden is placed or handled, water is controlled and other acts are performed by the operator in the process of uncovering and removing the mineral that affect the reclamation of the area of land affected;

(10) "topsoil" means the unconsolidated mineral matter

naturally present on the surface of the earth that has been subjected to and influenced by genetic and environmental factors of parent material, climate, macro- and microorganisms, and topography, all acting over a period of time, and that is necessary for the growth and regeneration of vegetation on the surface of the earth;

(11) "department" means the department of state lands provided for in title 82A, chapter 11;

(12) "commissioner" means the commissioner of state lands provided for in section 82A-1104;

(13) "board" means the board of land commissioners provided for in article X, section 4 of the constitution of this state;

(14) "reclamation" means backfilling, grading, highwall reduction, topsoiling, planting, revegetation, and other work to restore an area of land affected by strip mining under a plan approved by the department;

(15) "degree" means from the horizontal, and in each case is subject to a tolerance of five percent (5%) error;

(16) "contour strip mining" means that strip mining method commonly carried out in areas of rough and hilly topography in which the coal or mineral seam outcrops along the side of the slope and entrance is made to the seam by excavating a bench or table cut at and along the site of the seam outcropping with the excavated overburden commonly being cast down the slope below the mineral seam and the operating bench;

(17) "bench" means the ledge, shelf, table, or terraces formed in the contour method of strip mining;

(18) "fill bench" means that portion of a bench or table which is formed by depositing overburden beyond or down slope from the cut section as formed in the contour method of strip mining;

(19) "abandoned" means an operation where no mineral is being produced and where the department determines that the operation will not continue or resume.

Section 4. The board:

(1) shall issue after an opportunity for a hearing, orders requiring an operator to adopt the remedial measures necessary to comply with this act and rules adopted under this act;

(2) shall issue after an opportunity for a hearing, a final order directing the department to revoke a permit, when the requirements set forth by the notice of noncompliance, order of suspension, or an order of the board requiring remedial measures have not been complied with according to the terms herein;

(3) shall adopt after an opportunity for a hearing, general rules pertaining to strip mining to accomplish the purposes of this act;

(4) shall conduct hearings under provisions of this act or rules adopted by the board.

Section 5. The department:

(1) shall exercise general supervision, administration, and enforcement of this act and all rules and orders adopted under this act;

(2) shall examine and pass upon all plans and specifications submitted by the operator for the method of operation, backfilling, grading, highwall reduction, topsoiling and for the reclamation of

the area of land affected by his operation;

(3) shall order the suspension of any permit for failure to comply with this act or any rule adopted under this act;

(4) shall order the halting of any operation that is started without first having secured a permit as required by this act;

(5) shall make investigations and inspections necessary to insure compliance with this act;

(6) may encourage and conduct investigations, research, experiments and demonstrations, and collect and disseminate information relating to strip mining and reclamation of lands and waters affected by strip mining;

(7) may adopt rules with respect to the filing of reports, the issuance of permits and other matters of procedure and administration.

Section 6. (1) An operator may not engage in strip mining without having first obtained from the department a permit designating the area of land affected by the operation. The permit shall authorize the operator to engage in strip mining upon the area of land described in his application and designated in the permit for a period of one (1) year from the date of its issuance. Such permit shall be renewable from year to year thereafter upon application to the department at least thirty (30) but not more than sixty (60) days prior to the renewal date so long as the operator is in compliance with the requirements of this act, the rules hereunder, and the reclamation plan provided for in section 10 of this act, and agrees to comply with all applicable laws and rules in effect at the time of renewal. Such renewal shall further be subject to the denial provisions of sections 9 and 13 of this act.

(2) An operator desiring a permit shall file an application which shall contain a complete and detailed plan for the mining, reclamation, revegetation, and rehabilitation of the land and water to be affected by the operation. Such plan shall reflect thorough advance investigation and study by the operator and shall include all known or readily discoverable past and present uses of the land and water to be affected and the approximate periods of such use and shall state:

(a) the location and area of land to be affected by the operation, with a description of access to the area from the nearest public highways;

(b) the names and addresses of the owners of record of the surface of the area of land to be affected by the permit and the owners of record of all surface area within one-half (.5) mile of any part of the affected area;

(c) the names and addresses of the present owners of record of all subsurface minerals in the land to be affected;

(d) the source of the applicant's legal right to mine the mineral on the land affected by the permit;

(e) the permanent and temporary post office addresses of the applicant;

(f) whether the applicant or any person associated with the applicant holds or has held any other permits under this act, and an identification of those permits;

(g) whether the applicant is in compliance with subsection (2) of section 17 and whether every officer, partner, director, or any individual owning of record or beneficially (alone or with associates) if known, ten percent (10%) or more of any class of stock of the applicant, is subject to any of the provisions of subsection (2) of section 17 and he shall so certify, and whether any of the foregoing parties or persons have ever had a strip mining license or permit issued by any other state or federal agency revoked, or have ever forfeited a strip mining bond or a security deposited in lieu of a bond and if so, a detailed explanation of the facts involved in each case must be attached;

(h) the names and addresses of any persons who are engaged in strip mining activities on behalf of the applicant;

(i) the annual rainfall and the direction and average velocity of the prevailing winds in the area where the applicant has requested a permit;

(j) the results of any test borings or core samplings which the applicant or his agent has conducted on the land to be affected, including the nature and the depth of the various strata or overburden and topsoil, the quantities and location of subsurface water and its quality, the thickness of any mineral seam, an analysis of the chemical properties of such minerals, including the acidity, sulphur content, and trace mineral elements of any coal seam, as well as the british thermal unit (B.T.U.) content of such seam, and an analysis of the overburden, including topsoil. If test borings or core samplings are submitted, each permit application shall contain two (2) copies each of two (2) sets of geologic cross-sections accurately depicting the known geologic makeup beneath the surface of the affected land. Each set shall depict subsurface conditions at five hundred (500) foot intervals across the surface and shall run at a ninety (90) degree angle to the other set. Each cross-section shall depict the thickness and geological character of all known strata beginning with the top soil;

(k) the name and date of a daily newspaper of general circulation within the county in which the applicant has prominently published an announcement of his application for a strip mining permit, and a detailed description of the area of land to be affected should a permit be granted;

(l) such other or further information as the department may require.

(3) The application for a permit shall be accompanied by two (2) copies of all maps meeting the requirements of the subsections below. The maps shall:

(a) identify the area to correspond with the application;

(b) show any adjacent deep mining and the boundaries of surface properties and names of owners of record of the affected area and within one thousand (1,000) feet of any part of the affected area;

(c) show the names and locations of all streams, creeks, or other bodies of water, roads, buildings, cemeteries, oil and gas wells, and utility lines on the area of land affected and within one thousand (1,000) feet of such area;

(d) show by appropriate markings the boundaries of the area of land affected, any cropline of the seam or deposit of mineral to be mined, and the total number of acres involved in the area of land affected;

(e) show the date on which the map was prepared and the north point;

(f) show the drainage plan on and away from the area of land affected. This plan shall indicate the directional flow of water, constructed drainways, natural waterways used for drainage, and the streams or tributaries receiving the discharge;

(g) show the proposed location of waste or refuse area;

(h) show the proposed location of temporary subsoil and topsoil storage area;

(i) show the location of test boring holes;

(j) show the surface location lines of any geologic cross-sections which have been submitted;

(k) show a listing of plant varieties encountered in the area to be affected and their relative dominance in the area, together with an enumeration of tree varieties and the approximate number of each variety occurring per acre on the area to be affected, and the locations generally of the various kinds and varieties of plants, including but not limited to grasses, shrubs, legumes, forbs and trees;

(l) be certified as follows: "I, the undersigned, hereby certify that this map is correct, and shows to the best of my knowledge and belief all the information required by the strip mining laws of this state." The certification shall be signed and notarized. The department may reject a map as incomplete if its accuracy is not so attested;

(m) contain such other or further information as the department may require.

(4) In addition to the information and maps required above, each application for a permit shall be accompanied by detailed plans or proposals showing the method of operation, the manner, time or distance, and estimated cost for backfilling, grading work, highwall reduction, topsoiling, planting, revegetating, and a reclamation plan for the area affected by the operation, which proposals shall meet the requirements of this act and rules adopted under this act.

(5) An application fee of fifty dollars ($50) shall be paid before the permit required in this section shall be issued. The operator shall file with the department a bond payable to the state of Montana with surety satisfactory to the department in the penal sum to be determined by the board (on the recommendation of the commissioner) of not less than two hundred dollars ($200) nor more than twenty-five hundred dollars ($2,500) for each acre or fraction thereof of the area of land affected, with a minimum bond of two thousand dollars ($2,000), conditioned upon the faithful performance of the requirements set forth in this act and of the rules of the board. In determining the amount of the bond within the above limits, the board shall take into consideration the character and nature of the overburden, the future suitable use of the land involved and the cost of backfilling, grading, highwall reduction, topsoiling, and reclamation to be required; but in no event shall the bond be less than the total estimated cost to the state of completing the work described in the reclamation plan.

Section 7. The department may increase or reduce the area of land affected by an operation under a permit on application by an operator, but an increase may not extend the period for which an original permit was issued. An operator may, at any time within one (1) year from the date of issuance of the permit, apply to the department for an amendment of the permit so as to increase or reduce the acreage affected by it. The operator shall file an application and map in the same form and with the same content as required for an original application under this act and shall pay an application fee of fifty dollars ($50) and shall file with the department a supplemental bond in the amount to be determined under section 6 for each acre or fraction of an acre of the increase approved. If the department approves a reduction in the acreage covered by the original or supplemental permit, it shall release the bond for each acre reduced, but in no case shall the bond be reduced below two thousand dollars ($2,000), except as provided in subsection (5) of section 6.

Section 8. (1) On and after the effective date of this act prospecting by any person on land not included in a valid strip mining permit shall be unlawful without possessing a valid prospecting permit issued by the department as provided in this section. No prospecting permit shall be issued until the operator submits an application, the application is examined, amended if necessary, and approved by the department, and adequate reclamation performance bond is posted, all of which prerequisites must be done in conformity with the requirements of this act.

(2) An application for a prospecting permit shall be made in writing, notarized, and submitted to the department in duplicate upon forms prepared and furnished by it. The application shall include among other things, a prospecting map and a prospecting reclamation plan of substantially the same character as required for a surface mining map and reclamation plan under this act. The department shall determine, by rules and regulations, the precise nature of such required prospecting map and reclamation plan. Any operator who intends to prospect by means of core drilling shall specify the location and number of holes to be drilled, methods to be used in sealing aquifers, and such other information as may be required by the department. The applicant must state what types of prospecting and excavating techniques will be employed on the affected land. The application shall also include any other or further information the department may require.

(3) The application shall be accompanied by a fee of one hundred dollars ($100). This fee shall be used as a credit toward the strip mining permit fee provided by this act if the area covered by the prospecting permit becomes covered by a valid surface mining permit obtained before or at the time the prospecting permit expires.

(4) Before the department gives final approval to the prospecting permit application, the applicant shall file with the department a reclamation and revegetation bond in a form and in an amount as determined in the same manner for strip mining reclamation and revegetation bonds under this act.

(5) In the event that the holder of a prospecting permit desires to strip mine the area covered by the prospecting permit, and has fulfilled all the requirements for a strip mining permit, the department may permit the postponement of the reclamation of the acreage prospected if that acreage is incorporated into the complete reclamation plan submitted with the application for a strip mining permit. Any land actually affected by prospecting or excavating under a prospecting permit and not covered by the strip mining reclamation plan shall be promptly reclaimed.

(6) The prospecting permit shall be valid for one (1) year, and shall be subject to renewal, suspension, and revocation in the same manner as strip mining permits under this act.

(7) The holder of the prospecting permit shall file with the department the same progress reports, maps, and revegetation progress reports, as are required of strip mining operators under this act.

Section 9. (1) An application for a prospecting or strip mining permit shall not be approved by the department if there is found on the basis of the information set forth in the application, an on-site inspection, and an evaluation of the operation by the department that the requirements of the act or rules will not be observed or that the proposed method of operation, backfilling, grading, highwall reduction, topsoiling, revegetation, or reclamation of the affected area cannot be carried out consistent with the purpose of this act.

(2) The department shall not approve the application for prospecting or strip mining permit where the area of land described in the application includes land having special, exceptional, critical, or unique characteristics, or that mining or prospecting on that area would adversely affect the use, enjoyment, or fundamental character of neighboring land having special, exceptional, critical, or unique characteristics. For the purposes of this act, land is defined as having such characteristics if it possesses special, exceptional, critical or unique:

(a) biological productivity, the loss of which would jeopordize certain species of wildlife or domestic stock; or

(b) ecological fragility, in the sense that the land, once adversely affected, could not return to its former ecological role in the reasonable foreseeable future; or

(c) ecological importance, in the sense that the particular land has such a strong influence on the total ecosystem of which it is a part that even temporary effects felt by it could precipitate a system-wide reaction of unpredictable scope or dimensions; or

(d) scenic, historic, archeologic, topographic, geologic, ethnologic, scientific, cultural, or recreational significance. In applying this subsection, particular attention should be paid to the inadequate preservation previously accorded Plains Indian history and culture.

(3) If the department finds that the overburden on any part of the area of land described in the application for a prospecting or strip mining permit is such that experience in the state with a similar type of operation upon land with similar overburden shows that substantial deposition of sediment in streambeds, landslides, or water pollution cannot feasibly be prevented, the department shall delete that part of the land described in the application upon which the overburden exists.

(4) If the department finds that the operation will constitute a hazard to a dwelling house, public building, school, church, cemetery, commercial or institutional building, public road, stream, lake, or other public property, the department shall delete those areas from the prospecting or strip mining permit application before it can be approved.

Section 10. (1) As rapidly, completely, and effectively as the most modern technology and the most advanced state of the art will allow, each operator granted a permit under this act, shall reclaim and revegetate the land affected by his operation. Under the provisions of this act and rules adopted by the board, an operator shall prepare and carry out a method of operation, plan of grading, backfilling, highwall reduction, topsoiling and a reclamation plan for the area of land affected by his operation. In developing a method of operation, and plans of backfilling, grading, highwall reduction, topsoiling and reclamation, all measures shall be taken to eliminate damages to landowners and members of the public, their real and personal property, public roads, streams and all other public property from soil erosion, landslides, water pollution, and hazards dangerous to life and property. The reclamation plan shall set forth in detail the manner in which the applicant intends to comply with this section and sections 11, 12 and 13 of this act. The plan shall be submitted to the department and the department shall notify the applicant by registered mail within one hundred twenty (120) days after receipt of the plan and complete application if it is or is not acceptable. The department may extend the one hundred twenty (120)days an additional one hundred twenty (120) days upon notification of the operator in writing. If the plan is not acceptable, the department shall set forth the reasons why the plan is not acceptable and it may propose modifications, delete areas, or reject the entire plan. A land owner, operator, or any person aggrieved by the decision of the department may, by written notice, request a hearing by the board. The board shall notify the person by registered mail within twenty (20) days after the hearing of its decision. Every reclamation plan shall be subject to annual review and modification.

(2) In addition to the method of operation, grading, backfilling, highwall reduction, topsoiling and reclamation requirements of this act and rules adopted under this act, the operator, consistent with the directives of subsection (1) of this section shall:

(a) bury under adequate fill all toxic materials, shale, mineral, or any other material determined by the department to be acid producing, toxic, undesirable, or creating a hazard;

(b) seal off, as directed by rules, any breakthrough of water creating a hazard;

(c) impound, drain, or treat all runoff water so as to reduce soil erosion, damage to grazing and agricultural lands, and pollution of surface and subsurface waters;

(d) remove or bury all metal, lumber, and other refuse resulting from the operation;

(e) use explosives in connection with the operation only in accordance with department regulations designed to minimize noise, surface damage to adjacent lands and water pollution, ensure public safety, and for other purposes.

(3) An operator may not throw, dump, pile or permit the dumping, piling, or throwing or otherwise placing any overburden, stones, rocks, mineral, earth, soil, dirt, debris, trees, wood, logs or any other materials or substances of any kind or nature beyond or outside of the area of land which is under permit and for which a bond has been posted under section 6, or place the materials described in this section in such a way that normal erosion or slides brought about by natural physical causes will permit the materials to go beyond or outside of the area of land which is under permit and for which a bond has been posted under section 6.

Section 11. (1) Area strip mining, a method of operation which does not produce a bench or fill bench, is required. All highwalls must be reduced and the steepest slope of the reduced highwall shall be no greater than twenty (20) degrees from the horizontal. Highwall reduction shall be commenced at or beyond the top of the highwall and sloped to the graded spoil bank. Reduction, backfilling, and grading shall eliminate all highwalls and spoil peaks. The area of land affected shall be restored to the approximate original contour of the land. When directed by the department, the operator shall construct in the final grading, such diversion ditches, depressions, or terraces as will accumulate or control the water runoff. Additional restoration work may be required by the department according to rules adopted by the board.

(2) In addition to the backfilling and grading requirements, the operator's method of operation on steep slopes may be regulated and controlled according to rules adopted by the board. These rules may require any measure whatsoever to accomplish the purpose of this act.

(3) All available topsoil shall be removed in a separate layer, guarded from erosion and pollution, kept in such a condition that it can sustain vegetation of at least the quality and variety it sustained prior to removal, and returned as the top layer after the operation has been backfilled and graded; provided that the operator shall accord substantially the same treatment to any subsurface deposit of material that is capable, as determined by the department, of supporting surface vegetation virtually as well as the present topsoil.

(4) As determined by rules of the board, time limits shall be established requiring backfilling, grading, highwall reduction, topsoiling, planting, and revegetation to be kept current. All backfilling, grading, and topsoiling shall be completed before necessary equipment is moved from the operation.

(5) When the backfilling, grading, and topsoiling have been completed and approved by the department, the commissioner may release so much of the bond which was filed for that portion of the operation as the commissioner may determine, provided that no less than two hundred dollars ($200) per acre shall be retained by the department until such time as the planting and revegetation is done according to law and approved by the department, at which time the commissioner shall release the bond in the remaining amount.

(6) An operator may propose alternative plans other than backfilling, grading, highwall reduction, or topsoiling if the restoration will be consistent with the purpose of this act. These plans shall be submitted to the department, and, after consultation with the landowner, if the plans are approved by the board and complied with within the time limits as may be determined by the board as being reasonable for carrying out the plans, the backfilling, grading, highwall reduction, or topsoiling requirements of this act may be modified by the board. An operator who proposes alternative plans that will affect an existing permit shall comply with the notice requirement of section 6 (2) (k).

Section 12. After the operation has been backfilled, graded, topsoiled, and approved by the department, the operator shall prepare the soil and plant such legumes, grasses, shrubs, and trees upon the area of land affected as are necessary to provide a suitable permanent diverse vegetative cover capable of:

(a) feeding and withstanding grazing pressure from a quantity and mixture of wildlife and livestock at least comparable to that which the land could have sustained prior to the operation;

(b) regenerating under the natural conditions prevailing at the site, including occasional drought, heavy snowfalls, and strong winds; and

(c) preventing soil erosion to the extent achieved prior to the operation.

The seed or plant mixtures, quantities, method of planting, type and amount of lime or fertilizer, mulching, irrigation, fencing, and any other measures necessary to provide a suitable permanent diverse vegetative cover shall be defined by rules of the board.

Section 13. The operator shall commence the reclamation of the area of land affected by his operation as soon as possible after the beginning of strip mining of that area in accordance with plans previously approved by the department. Those grading, backfilling, topsoiling, and water management practices that are approved in the plans shall be kept current with the operation as defined by rules of the board and a permit or supplement to a permit may not be issued, if in the discretion of the department, these practices are not current.

Section 14. (1) At least sixty (60) days prior to the date of each permit expiration, the operator shall file a planting report with the department on a form to be prescribed and furnished by the department, giving the following information:

(a) identification of the operation;

(b) the type of planting or seeding, including mixtures and amounts:

(c) the date of planting or seeding;

(d) the area of land planted;

(e) any other relevant information the department requires.

(2) All planting reports shall be certified by the operator.

(3) Inspection and evaluation for permanent diverse vegetative cover shall be made as soon as it is possible to determine if a satisfactory stand has been established. If the department determines that a satisfactory permanent diverse vegetative cover has been established, it shall release the remaining bond held on the area reclaimed after public notice and an opportunity for a hearing; but in no event shall such remaining bond be released prior to a period of five (5) years from the initial planting provided for in section 12 of this act.

Section 15. All legumes, grasses, shrubs, and trees which are planted or seeded on the area of land affected as required by this act or rules adopted under this act, become the property of the landowner, after complete release of the bond, unless the operator and the landowner agree otherwise.

Section 16. Within sixty (60) days after each date of expiration of a permit, the operator shall annually file with the department a report stating the exact number of acres of land affected by the operation, the extent of the reclamation already accomplished by him, and any other information required by the rules of the department and the board. The report shall be accompanied by a copy of the map filed with the original application which shall show any revisions made necessary by results of the operation.

Section 17. (1) If any of the requirements of this act or rules or orders of the department and the board have not been complied with within the time limits set by the department or the board or by this act, the department shall serve a notice of noncompliance on the operator, or where found necessary, the commissioner shall order the suspension of a permit. The notice or order shall be handed to the operator in person or served by registered mail addressed to the permanent address shown on the application for a permit. The notice of noncompliance or order of suspension shall specify in what respects the operator has failed to comply with this act or the rules or orders of the department and the board. If the operator has not complied with the requirement set forth in the notice of noncompliance or order of suspension within time limits set therein, the permit may be revoked by order of the board and the performance bond forfeited to the department.

(2) Any additional permits held by an operator whose mining permit has been revoked shall be suspended and the operator is not eligible to receive another permit or to have the suspended permits reinstated until he has complied with all the requirements of this act in respect to former permits issued him. An operator who has forfeited a bond is not eligible to receive another permit unless the land for which the bond was forfeited has been reclaimed without cost to the state, or the operator has paid into the reclamation account a sum together with the value of the bond, the board finds adequate to reclaim the lands. The department may not issue any additional permits to an operator who has repeatedly been in noncompliance or violation of this act.

Section 18. Where one operator succeeds another at an uncompleted operation, either by sale, assignment, lease, or otherwise, the department may release the first operator from all liability under this act as to that particular operation if both operators have been issued a permit and have otherwise complied with the requirements of this act, and the successor operator assumes as part of his obligation under this act, all liability for the reclamation

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of the area of land affected by the former operator.

Section 19. (1) All fees, forfeit funds, and other moneys available or paid to the department under the provisions of this act shall be placed in the state treasury and credited to a special agency account to be designated as the strip mining and reclamation fund. This fund shall be available to the department by appropriation and shall be expended for the administration and enforcement of this act and for the reclamation and revegetation of land and the rehabilitation of water affected by any mining operations. Any unencumbered and any unexpended balance of this fund remaining at the end of any fiscal year shall not lapse but shall be carried forward for the purposes of this act until expended or until appropriated by subsequent legislative action.

Section 20. (1) The board may receive any federal funds, state funds, or any other funds for the reclamation of land affected by strip mining. The board may have reclamation work done by its own employees or by employees of other governmental agencies, soil conservation districts, or through contracts with qualified persons.

(2) Any funds or any public works programs available to the board shall be used and expended to reclaim and rehabilitate lands that have been subjected to strip mining that have not been reclaimed and rehabilitated in accordance with the standards of this act.

Section 21. The board may reclaim, in keeping with the provisions of this act, any affected lands with respect to which a bond has been forfeited and to use moneys appropriated from the strip mining and reclamation fund for such purposes.

Section 22. A resident of this state, with knowledge that a requirement of this act or a rule adopted under this act, is not being enforced by a public officer or employee whose duty it is to enforce the requirement or rule may bring the failure to enforce to the attention of the public officer or employee by a written statement under oath that shall state the specific facts of the failure to enforce the requirement or rule. Knowingly making false statements or charges in the affidavit subjects the affiant to penalties prescribed under the law of perjury.

(2) If the public officer or employee neglects or refuses for an unreasonable time after receipt of the statement to enforce the requirement or rule, the resident may bring an action of mandamus in the district court of the first judicial district of this state, in and for the county of Lewis and Clark, or in the district court of the county in which the land is located. The court, if it finds that a requirement of this act or a rule adopted under this act, is not being enforced shall order the public officer or employee, whose duty it is to enforce the requirement or rule, to perform his duties. If he fails to do so, the public officer or employee shall be held in contempt of court and is subject to the penalties provided by law.

(3) An owner of an interest in real property who obtains all or part of his supply of water for domestic, agricultural, industrial, or other legitimate use from an underground source other than a subterranean stream having a permanent, distinct, and known channel, may sue an operator to recover damages for contamination, diminution, or interruption of the water supply, proximately resulting from strip mining.

(4) A servient tract of land is not bound to receive surface water contaminated by strip mining on a dominant tract of land, and the owner of the servient tract may sue an operator to recover the damages proximately resulting from the natural drainage from the dominant tract of surface waters contaminated by strip mining on the dominant tract.

(5) This section does not create, modify, or affect any right, liability, or remedy other than as expressly provided in this section.

Section 23. (1) A person or operator who violates any of the provisions of this act or rules or orders adopted under this act shall pay a civil penalty of not less than one hundred dollars ($100) nor more than one thousand dollars ($1,000) for the violation, and an additional civil penalty of not less than one hundred dollars ($100) nor more than one thousand dollars ($1,000) for each day during which a violation continues, and may be enjoined from continuing such violations as hereinafter provided in this section. These penalties shall be recoverable in any action brought in the name of the state of Montana by the attorney general in the district court of the first judicial district of this state, in and for the county of Lewis and Clark, or in the district court having jurisdiction of the defendant.

(2) The attorney general shall, upon the request of the commissioner, sue for the recovery of the penalties provided in this section for, and bring an action for a restraining order, temporary or permanent injunction, against an operator or other person violating or threatening to violate an order adopted under this act.

(3) A person who willfully violates any of the provisions of this act, or any determination or order adopted under this act which has become final is guilty of a misdemeanor and shall be fined not less than five hundred dollars ($500) and not more than five thousand dollars ($5,000). Each day on which a violation occurs constitutes a separate offense.

Section 24. All hearings and appeal procedures shall be in accordance with sections 82-4209 through 82-4217.

Section 25. If a part of this act is invalid, all valid parts that are severable from the invalid part remain in effect. If a part of this act is invalid in one or more of its applications, the part remains in effect in all valid applications that are severable from the invalid applications.

Section 26. Sections 50-1018 through 50-1033, R.C.M. 1947, are repealed.

Section 27. Every operator shall within ninety (90) days after the effective date of this act file with the department an application for a permit.

Section 28. Ninety (90) days after the effective date of this act, the state shall proceed to cancel, according to their terms, all existing contracts entered into pursuant to chapter 245, laws of Montana, 1967. If the contract does not provide according to its terms, for the cancellation, it shall be terminated and void within two hundred seventy (270) days from the effective date of this act.

Section 29. This act is effective on its passage and approval.

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